ZooKeys 20: 299–348 (2009)
doi: 10.3897/zookeys.20.108
www.pensoftonline.net/zookeys

RESEARCH ARTICLE

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Revision of Khoikhoiinae (Hymenoptera, Braconidae)

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Academic editor: *Norman Johnson* | Received 21 February 2009 | Accepted 17 June 2009 | Published 14 September 2009

urn:lsid:zoobank.org:pub:4AA0293D-DEC8-424C-9053-1CDD965CCC82

Citation: Sharkey M, van Noort S, Whitfield J (2009) Revision of Khoikhoiinae (Hymenoptera, Braconidae). In: Johnson N (Ed) Advances in the systematics of Hymenoptera. Festschrift in honour of Lubomír Masner. ZooKeys 20: 299–348. doi: 10.3897/zookeys.20.108

Abstract

The species of the two genera of Khoikhoiinae (Hymenoptera, Braconidae) are revised. Thirteen species are recognized, of which five are new and eight were previously described: *Khoikhoia anthelion* Sharkey, **sp. n.**, *K. lission* Mason, 1984, *K. oligospilos* Sharkey, **sp. n.**, *K. semiadusta* Mason, 1983, *K. solata* Mason, 1983, *K. townesi* Mason, 1983, *K. turneri* Mason, 1984, *Sania browni* Sharkey, **sp. n.**, *S. capensis* Mason, 1983, *S. henryi* Mason, 1983, *S. marjoriae* Mason, 1983, *S. masneri* Sharkey, **sp. n.**, and *S. masoni* Sharkey, **sp. n.** All are from the Cape Region of South Africa, and all but one species are confined to the western Cape. A dichotomous key to species is presented; links to electronic interactive keys and to distribution maps are also included. Based on phylogenetic position and morphological characters, speculations on life history are made, and it is suggested that some species may be parasitoids of wood- or stem-boring Lepidoptera. The DELTA data matrix and images for the key are available at 10.3897/zookeys.20.108.app.1.ik; Intkey files are available at 10.3897/zookeys.20.108.app.2.ik; Lucid files in LIF and SDD format are available at: doi:10.3897/zookeys.20.108.app.3.ik and doi:10.3897/zookeys.20.108.app.4.ik. Publishing of DELTA raw data will facilitate future workers to edit keys and to add newly discovered taxa.

Keywords

South Africa, parasitoid wasps, Lepidoptera, *Khoikhoia*, *Sania*, taxonomy, systematics

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Introduction

Khoikhoiinae is a small subfamily of braconids in the microgastroid complex that is restricted to the Cape Region of South Africa. It was proposed by Mason (1983), who included two new genera, *Khoikhoia* and *Sania*, and six species, three of each genus. He also discussed its phylogenetic position within the microgastroid complex, and differentiated it from the morphologically somewhat similar Cardiochilinae. Mason (1984) added two species that he discovered in the British Museum and added characters that further differentiated the two genera. Here we describe five new species and re-describe Mason's species. A fully illustrated dichotomous key is presented and links to on-line interactive and dichotomous keys are included.

Mason proposed generic limits and synapomorphies, and described eight species based on only 11 specimens. We examined 76 specimens in the course of this study. Naturally some of Mason's (1983, 1984) conclusions now seem to be erroneous in light of the new data. For example, in Mason's (1983) key, he used several characters to distinguish the two genera that we have discovered to be present in both. We too are still working with a very limited set of specimens and our conclusions are tentative.

Materials and methods

All species descriptions and the dichotomous key were generated using DELTA software (http://delta-intkey.com). Data, species names, characters and character states were entered into Delta Editor (Dallwitz 1980; Dallwitz et al. 1999). The "tokey" file was edited to select and weight the characters used for the dichotomous key, and the modified file was exported from DELTA to produce the key which was then lightly edited to produce the final version (Dallwitz 1974; Dallwitz 1980; Dallwitz et al. 1993). The interactive key was produced in a similar manner using the DELTA file "toint" and the software IntKey (Dallwitz 1980; Dallwitz et al. 1993; Dallwitz et al. 1995). All source files and images used in this publication are available http://sharkeylab.org/sharkeylab/Misc/datasets/DeltaFiles/KhoikhoiinaeDeltaFiles.zip and in Appendix 1 of the present paper (doi:10.3897/zookeys.20.108.app.1.ds). These files are open to the public and future researchers are welcome to download them if they wish to modify, correct, or add to it for publication. All new species have been registered with Zoobank (Polaszek et al. 2005).

Online interactive matrix and dichotomous keys were also produced using Lucid (www.lucidcentral.org), and are available on Waspweb at: http://www.waspweb.org/Ichneumonoidea/Braconidae/Keys/index.htm. The key to Khoikhoiinae is available in three formats. Lucid Phoenix keys are dichotomous and a choice needs to be made at each key couplet to continue. Lucid matrix keys, on the other hand, use a different approach where relevant states from multiple character features can be selected independently until identification is achieved. For more information concerning Lucid keys visit www.lucidcentral.org <http://

www.lucidcentral.org>. Files are provided as appendices in two formats enabling conversion of the Lucid matrix key to other platforms. 1. Lucid Interchange Format version 3 (LIF3) files are XML-based files that store all the Lucid3 key data, allowing exchange of the key with other key developers. 2. SDD files are XML-based files structured using the internationally agreed SDD (Structure of Descriptive Data) Schema. SDD files may be used to exchange Lucid keys with other SDD-compliant applications.

Measurements were taken with a Microcode II stage measurement device manufactured by Boeckeler Instruments.

Images were taken with three different instrument systems: 1. Automontage software using a 3CCD JVC digital camera attached to a Leica MZ16 stereo microscope. 2. EntoVision micro-imaging system. This system included a Leica M16 compound microscope with a JVC KY-75U 3-CCD digital video camera attached that fed image data to a notebook. The program Cartograph 5.6.0 was then used to merge an image series into a single in-focus image. Lighting was achieved using techniques summarized in Buffington et al. (2005), Kerr et al. (2009) and Buffington and Gates (2009). 3. SEM photographs of gold coated specimens and ESEM photographs of uncoated type series specimens were taken with a Philips XL30 ESEM-FEG field-emission environmental scanning electron microscope at the Imaging Technology Group, Beckman Institute, University of Illinois, with digital images captured directly onto computer.

Species descriptions are for the holotype specimen. If the holotype was a male and female specimens were known, the female specimens was used to describe female specific characters. Within the holotype description, variation in other specimens of both sexes is given in angled brackets, < >. Where there are clear differences in male and female specimens in non-sexual characters these are mentioned in a separate section below the holotype description.

Museum depositories:

American Entomological Institute (AEI) 3005 SW 56th Avenue, Gainesville, FL 32608-5047, USA.

Canadian National Collection of Insects (CNCI) Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-Food Canada, K.W. Neatby Building, 960 Carling Ave. Ottawa, Ontario K1A 0C6, CANADA

Illinois Natural History Survey (INHS) 1816 South Oak Street, MC 652, Champaign, IL 61820.

Iziko South African Museum (SAMC) Natural History Division, South African Museum, Iziko Museums of Cape Town, PO Box 61, Cape Town 8000, South Africa.

Hymenoptera Institute Collection (HIC) Department of Entomology, University of Kentucky, Lexington, Kentucky 40546–0091, USA.

The Natural History Museum (BMNH) Cromwell Road, London SW7 5BD, UK.

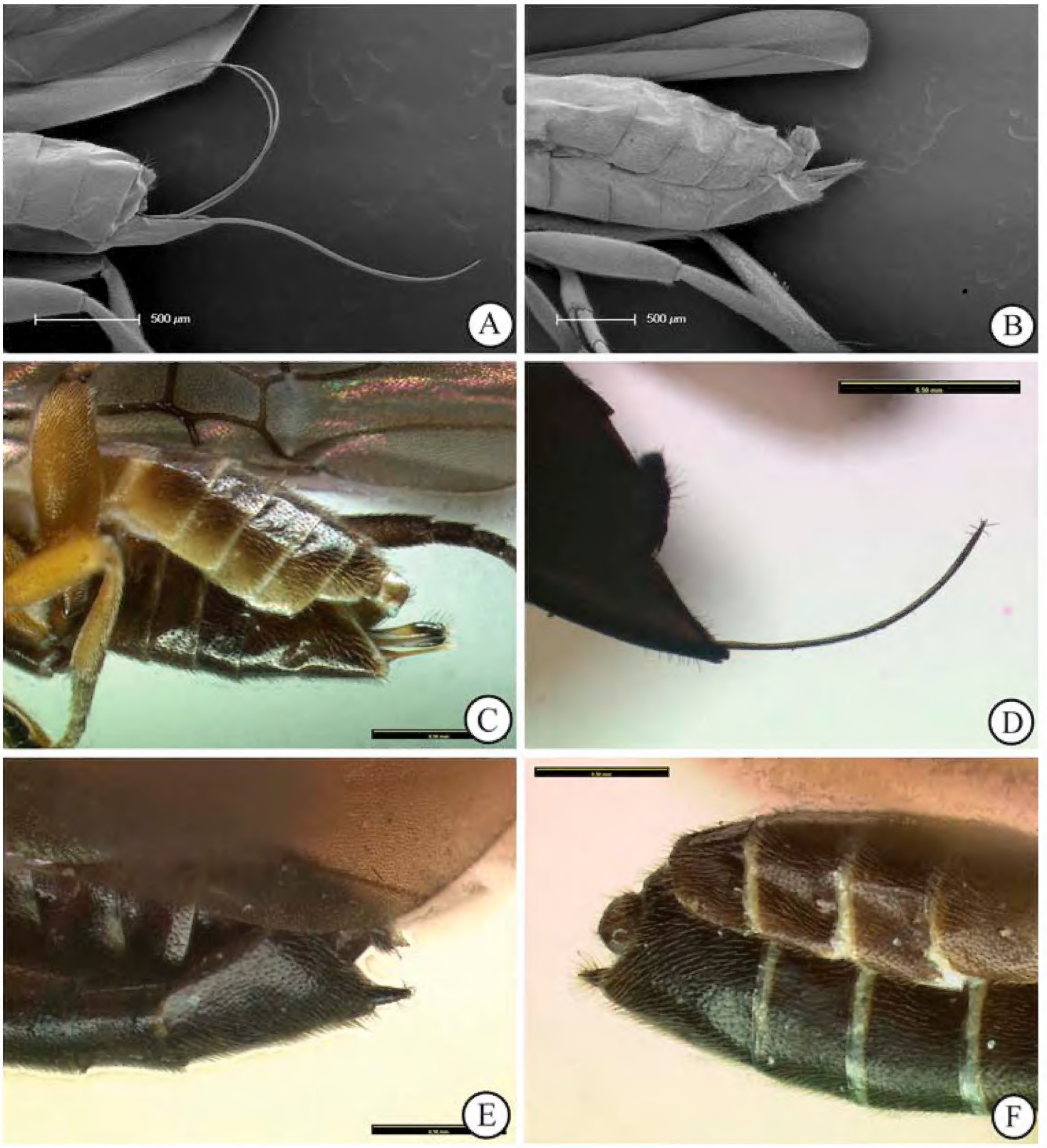


Figure 1. Ovipositor morphology, showing variation within Khoikhoiinae **A** *Sania marjoriae* Mason 1983 **B** *Sania masoni* Sharkey, sp. n. **C** *Sania browni* Sharkey, sp. n. **D** *Sania masneri* Sharkey, sp. n. **E** *Khoikhoia turneri* Mason, 1984 **F** *Khoikhoia townesi* Mason, 1983.

Life history and evolution

Host associations are unknown for all species of Khoikhoiinae; however, morphological and phylogenetic clues allow for some conjecture. All reliable host records for members of the microgastroid braconids are Lepidoptera, although occasional uncorroborated records from other insect orders have been published, and one reasonable record is from Trichoptera (Achterberg 2002). Phylogenetic studies of the microgastroids (re-

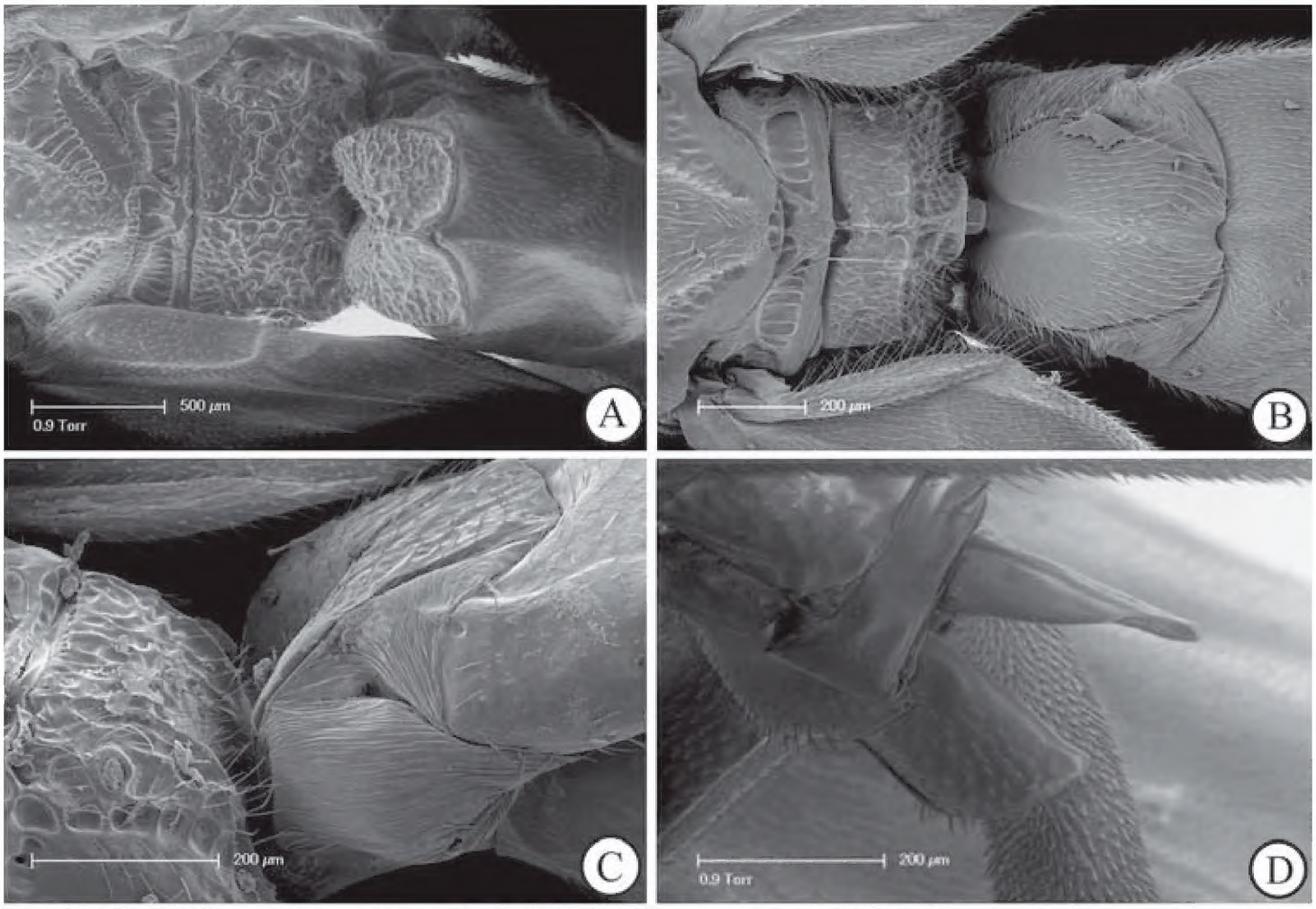


Figure 2. Scanning electron micrographs **A** *Khoikhoia anthelion* Sharkey, sp. n., female, mesosoma and first two metasomal tergites, dorsal view **B** *Sania browni* Sharkey, sp. n., female, propodeum and first three metasomal tergites, dorsal view **C** *Sania marjoriae* Mason, 1983, female, propodeum and laterotergites, lateral view **D** *Sania masneri* Sharkey, sp. n., male, genitalia **E** *Sania masoni* Sharkey, sp. n., male, metasoma, lateral view, showing genitalia **F** *Khoikhoia anthelion* Sharkey, sp. n., female, ovipositor, lateral view.

viewed in Murphy et al. 2008), although far from robust in support for some clades, clearly place Cheloninae as sister to the remaining subfamilies, so we can infer that members of Khoikhoiinae are parasitoids of Lepidoptera. All microgastroids are larval or egg-larval parasitoids (attacking the egg stage and developing in the larval stage). Since egg-larval parasitism occurs in all known chelonines and is also present in many microgastrines, it could possibly be part of the ground plan for the non-chelonine microgastroids (Ruberson and Whitfield 1996). The very thin, sharp ovipositors of khoikhoiines (Figs. 1, 2F) are consistent with this scenario.

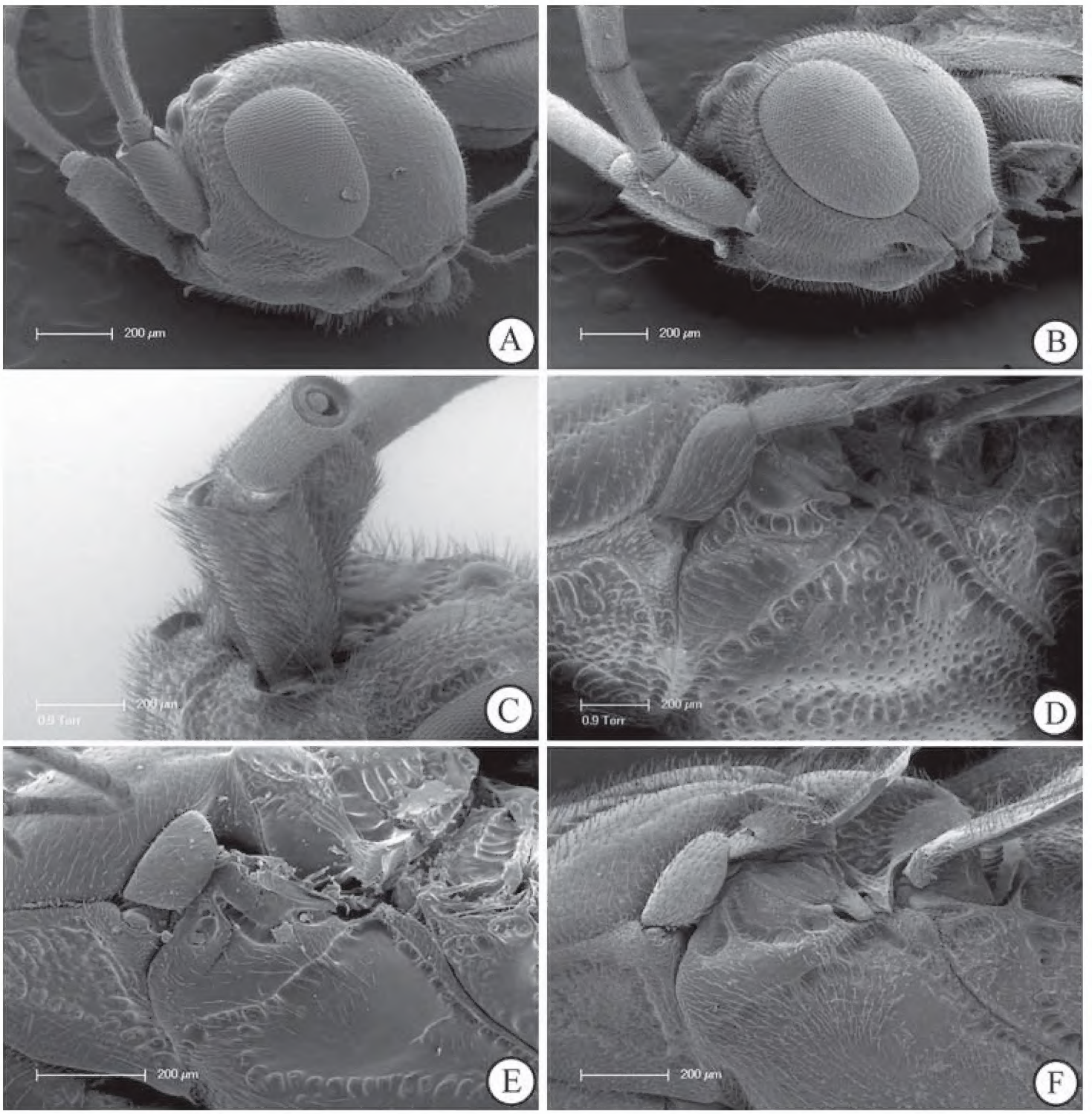


Figure 3. Scanning electron micrographs **A** *Sania marjoriae* Mason, 1983, female, head lateral view **B** *Sania masoni* Sharkey, sp. n., female, head, lateral view **C** *Khoikhoia anthelion* Sharkey, sp. n., female, antennal scape (showing apical flange) and details of antennal scrobe, lateral view **D** *Khoikhoia anthelion* Sharkey, sp. n., female, subalar region, lateral view **E** *Sania marjoriae* Mason, 1983, female, subalar region, lateral view **F** *Sania masoni* Sharkey, sp. n., female, subalar region, lateral view.

Many ichneumonoids that emerge from the host larvae after it has spun a pupal chamber have twisted mandibles that are thought to be effective in cutting through the silken threads of their host. This is the case with many members of Microgastrinae. The family Agathidinae consists exclusively of parasitoids of Lepidoptera larvae, and most members have twisted scissor-like mandibles. The one known exception to this is in the clade composed of the genera *Crassomicrodus* and *Agathirsia*, both of which are found primarily in semiarid regions of the southwest of the USA, Mexico and Central America (Pucci and Sharkey 2004). Although it is necessary to extract from only one

host record (*Acontia cretata* Noctuidae), these are parasitoids of caterpillars that do not spin cocoons, and cutting mandibles are not required to escape the host's silken chamber. We suspect, therefore, that the hosts of khoikhoiines do not spin cocoons.

Another odd morphological characteristic possessed by many species of Khoikhoiinae is a well-excavated antennal scrobe (Figs. 3A–B). This is a feature that, in the Braconidae at least, is restricted to taxa attacking wood-boring hosts. The antennal scrobes function to protect the antennae as the adult braconid emerges from woody substrate. These braconids, e.g., *Helcon*, *Capitonious*, also have robust mandibles much like those of khoikhoiines.

Perhaps the most informative characteristic of Khoikhoiinae is the flared scape. The scape of all species of *Khoikhoia,* and two species of *Sania* (*S. marjoriae, and S. masneri*), is flared apically and the apical surface is not a simple ridge, but rather it includes an area with considerable surface (Figs. 3A–C). This is another characteristic that, within the Braconidae, is restricted to species attacking wood-boring hosts, e.g. many Braconinae including *Cyclaulax* and *Hemibracon* (see Figs. 37 and 41 in Quicke 1997). We do not believe that there has been any published conjecture on function, but we suggest that these structures are used to help prevent back-slippage when the adult wasp is escaping its host's habitat through a wooden tunnel. While moving forward through the tunnel the scape would be directed posteriorly and housed within the antennal scrobe. The flanged part of the scape would be directed posterodorsally. As the wasp moved forward in the tunnel the scape would be pushed against the scrobe but any backwards movement would cause the flange of the scape to lock into the dorsal surface of the tunnel. In essence the movement of the wasp forward in the tunnel is analogous to a ratchet.

Four of the six species of *Sania* do not have a strongly flared scape and also lack a well-developed antennal scrobe. Also, the species of *Sania* have less robust mandibles compared with those of *Khoikhoia*. The four species of *Sania* that lack a flared scape (*S. browni, S. capensis, S. henryi*, and *S. masoni*) may not be attacking wood-boring hosts.

In summary, we posit that some members of Khoikhoiinae attack wood-boring (or possibly stem-boring or woody inflorescence boring) Lepidoptera. Inflorescences and infructescences of *Protea* species are bored by the larvae of a range of coleopteran and lepidopteran species (Coetzee and Giliomee 1987, Wright and Samways 1999, 2000). The most likely candidate would be a basal lepidopteran clade that is restricted, or mostly confined, to the Cape Region of South Africa, where all species of Khoikhoiinae have been collected. Another potential host candidate is a lepidopteran that feeds on roots, in which case the antennal and mandibular modifications of Khoikhoiinae might be used to tunnel through densely packed soil. One candidate host clade is the enigmatic Prototheoridae (Lepidoptera: Hepialoidea). This family is confined to southern Africa, and most diverse in the Cape region of South Africa (Davis 1996). Unfortunately knowledge of its life history is lacking.

Khoikhoiinae are associated with the Fynbos and Succulent Karoo biomes (Rutherford et al. 2006), which form the major component of the Cape Floristic region. These biomes have been recognized as globally important biodiversity hotspots (Myers et al. 2000; Latimer 2005), as well as a center of distribution and endemism for plants (Cowling et al. 1998), and numerous invertebrate taxa, including the figitid subfamily Pycnostigminae and the recently discovered insect order Mantophasmatodea,

both groups having their center of species richness in the Cape Region (Picker et al. 2002, Buffington and van Noort 2007, Damgaard et al. 2008). It is plausible that the Khoikhoiinae may have diversified with the evolution and radiation of the Cape Floristic Region 3–5 million years ago (Goldblatt 1997; Linder et al. 1992; Linder 2003).

Several of the new species described here were collected in significant numbers in Malaise traps. For example, 21 specimens of *Sania masoni* were collected over a 20 day period from a single Malaise trap. This suggests that khoikhoiines may be locally common, and is consistent with the idea some species or their hosts are gregarious.

Relationships among member subfamilies in the microgastroid complex are discussed by Mason (1983) and Whitfield and Mason (1994) with respect to morphological evidence, and by Murphy et al. (2008) with respect to molecular evidence from seven genes. Despite analyses of a relatively large amount of DNA sequence data (Murphy et al. 2008) and of a significant data set of comparative morphological characters (Whitfield and Mason 1994), the exact placement of Khoikhoiinae among the nonchelonine microgastroids is still uncertain, although its inclusion within this complex is highly supported. Our understanding is likely to improve considerably when the host biology and larval stages of khoikhoiines become known, and when a larger sample of the fauna can be included in molecular phylogenetic analysis (the study by Murphy et al. (2008) featured only one *Khoikhoia* and three *Sania* species). The recent study of bracovirus origins in the microgastroid complex by Bezier et al. (2009) attempted to confirm the presence of bracovirus structural genes across the complex using PCR, but was unable to confirm the presence of these genes in either *Sania* or *Khoikhoia*. It is nevertheless likely, due to the phylogenetic position of khoikhoiines, that they do contain mutualistic bracoviruses, and that the negative PCR results were due to either mismatches in primer design or marginal specimen quality for molecular study.

Key to genera and species of Khoikhoiinae

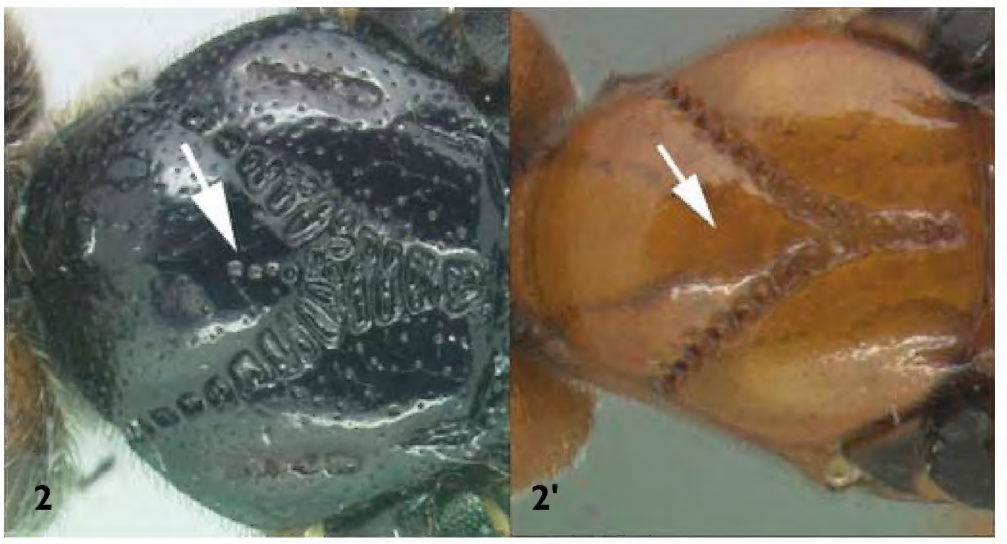
An illustrated, interactive IntKey is available at http://sharkeylab.org/sharkeylab/sharkeyKeys.php. Interactive Lucid matrix and Lucid Phoenix keys are available at: http://www.waspweb.org/Ichneumonoidea/Braconidae/Keys/index.htm

1. Clypeus with medial tooth..... ***Khoikhoia*** **2**

1' Clypeus without medial tooth..... ***Sania*** **8**

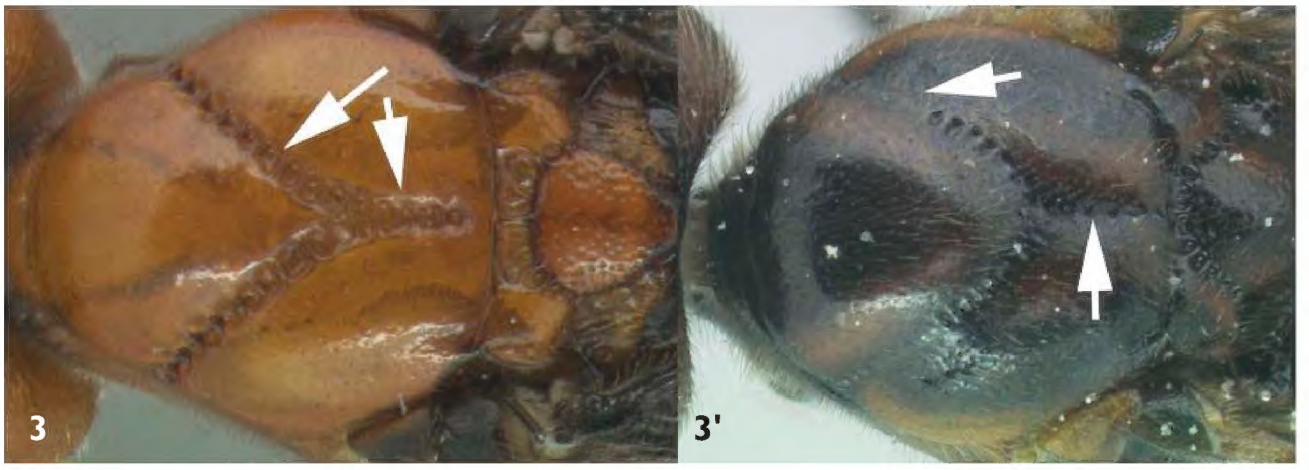
2(1). Several large punctures arranged in a longitudinal row on middle lobe of mesoscutum posteromedially..... ***Khoikhoia anthelion*** **Sharkey, sp. n.**

2' Medial lobe of mesoscutum lacking longitudinal row of large punctures posteromedially..... **3**



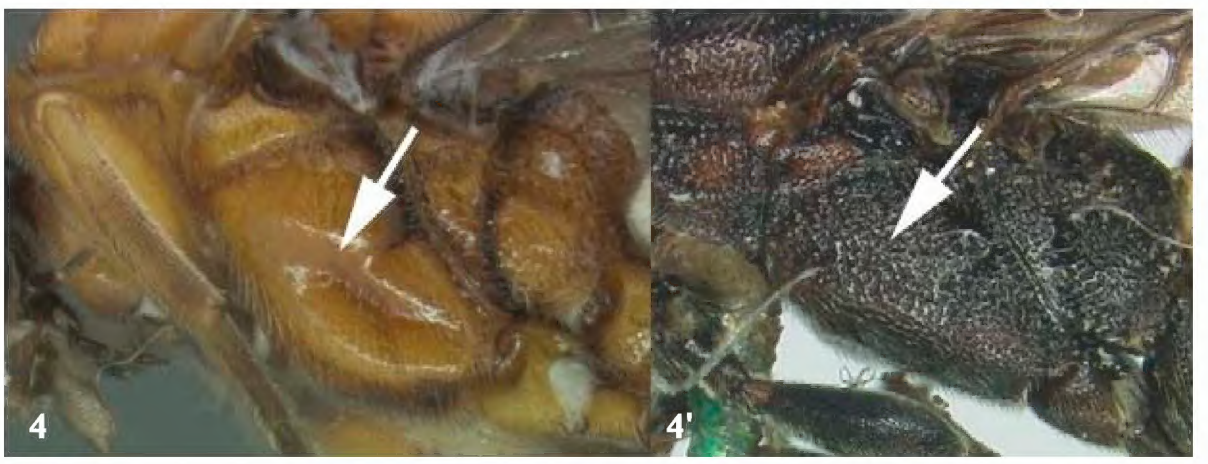
3(2). Notauli entirely crenulate. **4**

3' Notauli crenulations weak and partly effaced ..... ***Khoikhoia oligospilos*** **Sharkey, sp. n.**



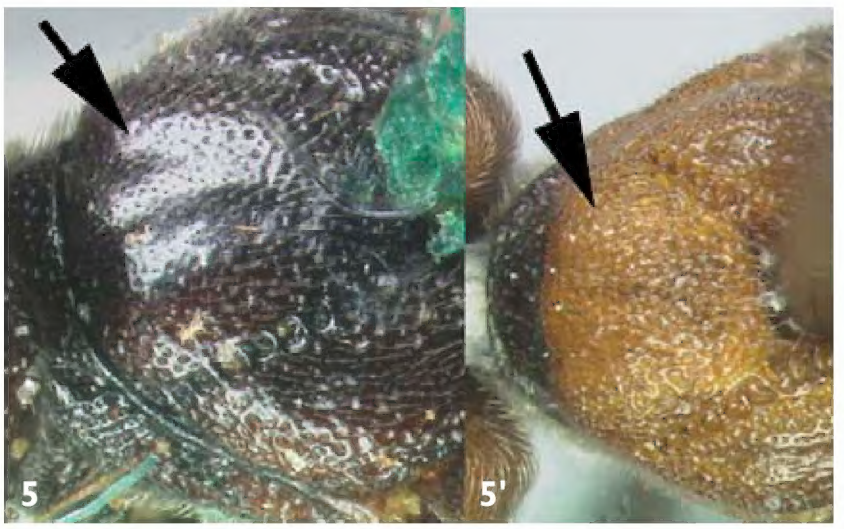
4(3). Mesopleuron at least partly smooth with punctures **6**

4' Mesopleuron entirely rugosopunctate or rugose..... **5**



5(4). Middle lobe of scutum smooth with punctures anteromedially, otherwise rugosopunctate..... ***Khoikhoia turneri*** **Mason**

5' Middle lobe of scutum entirely rugosopunctate ..... ***Khoikhoia townesi*** **Mason**

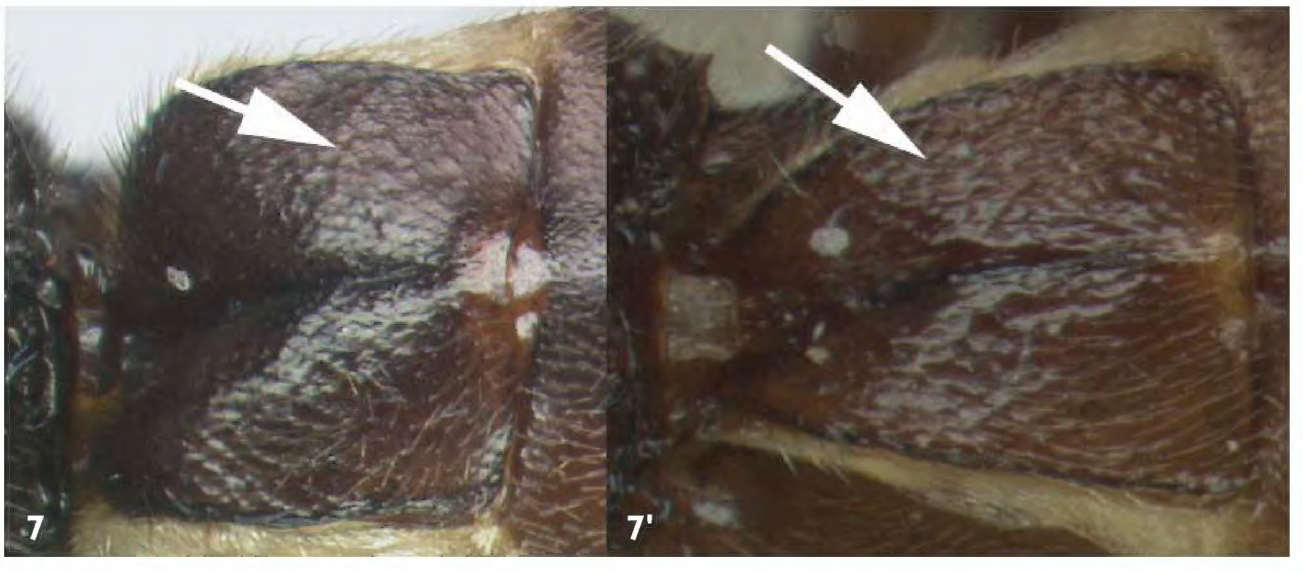


6(4). Mesosoma entirely black except tegula somewhat paler..... ***Khoikhoia semiadusta*** **Mason**

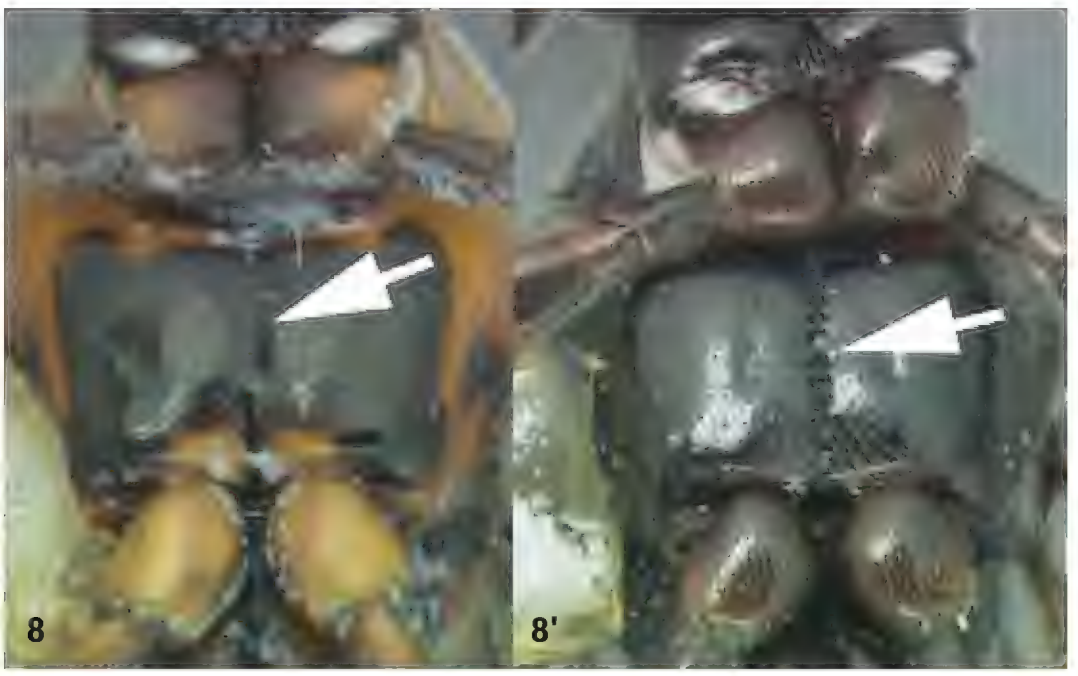
6' Mesosoma partly brown.....7

7(6). Median tergite 1 mostly smooth with weak microsculpture ..... ***Khoikhoia solata*** **Mason**

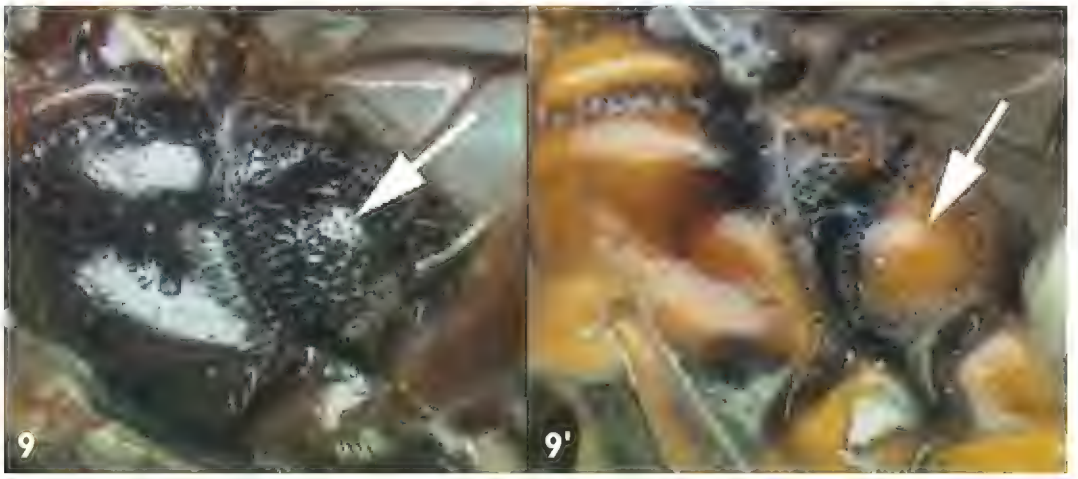
7' Median tergite 1 mostly rugose.....***Khoikhoia lission*** **Mason**



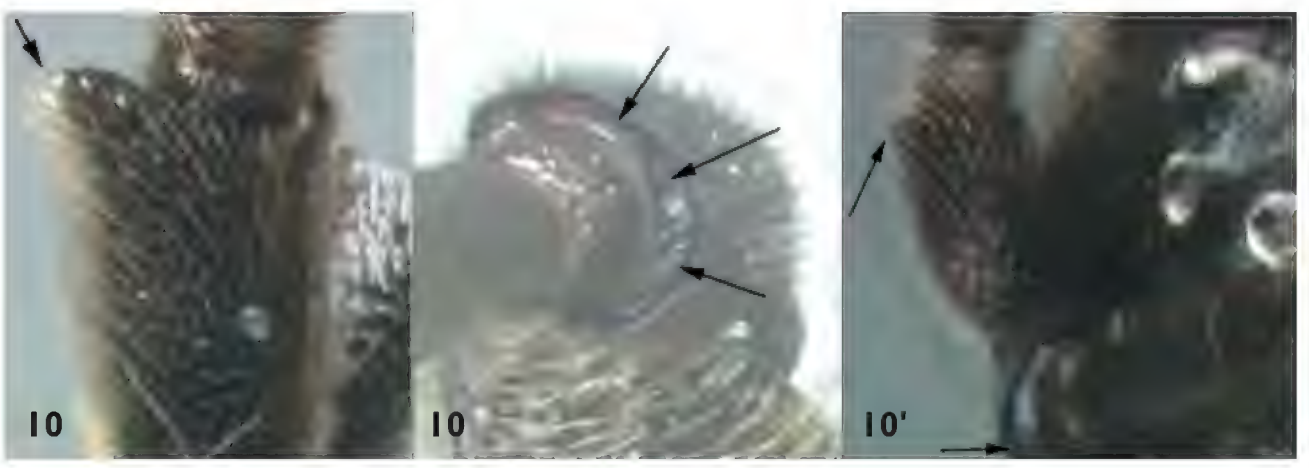
8(1). Discrimen smooth or with a few barely perceptible crenulae.....**9**
8' Discrimen crenulate.....**10**



9(8). Metapleuron mostly rugose, lacking a large smooth lightly punctate area.....
..... ***Sania capensis* Mason**
9' Metapleuron partly rugose but with a large smooth lightly punctate area.....
..... ***Sania browni* Sharkey, sp. n.**



10(8). Scape flared apicoanteriorly with expanded apical surface **11**
10' Scape not flared apicoanteriorly and lacking expanded apical surface **12**



11(10). Median tergite 1 partly smooth posterolaterally, rugose anteriorly; posterolateral margin straight..... ***Sania masneri* Sharkey, sp. n.**

11' Median tergite 1 completely rugose; posterolateral margin curved ..... ***Sania marjoriae* Mason**

12(10). Median tergite 1 partly smooth posterolaterally, rugose anteriorly..... ***Sania masoni* Sharkey, sp. n.**

12' Median tergite 1 completely rugose ..... ***Sania henryi* Mason**

Taxonomy

***Khoikhoiinae* Mason, 1983**

Description. Head. Number of flagellomeres variable within species ranging from about 20–40, antenna often sexually dimorphic, female flagellum compressed apically with flagellomeres shorter and wider than males, sometimes flagellomeres transverse in females, though usually slightly to 3× longer than wide; flagellomeres sometimes sexually dimorphic with flagellum of females tapering strongly towards apex, males tapering slightly as in most other microgastroids; (this type of dimorphism is also found in a number of species of Cheloninae, e.g., *Ascogaster abdominator* (Dahlbom, 1833)); flagellar placodes short, about 1/3 to 1/4 length of flagellomeres in males, not arranged into two rows; antennal scrobe present, though weak in most species of *Sania*; frons with elevated, coarsely sculptured, protuberance laterad antennal scrobe, effectively increasing functional depth of scrobe, protuberance

variously developed from weak to strong depending on species and generally more developed in members of *Khoikhoia*; malar suture distinct; mandible thick and long, not greatly twisted to function as scissors; temple large, presumably to hold large mandibular muscles; maxillary palpus 5-segmented, basal two segments fused; labial palpus 4-segmented; labrum setose, semicircular, usually exposed but capable of folding behind the clypeus, clypeus weakly concave (*Sania*) or with median and sometimes lateral teeth (*Khoikhoia*).

Mesosoma. Propleuron lacking carina on posterolateral margin and lacking ventral flange overlapping ventral corner of pronotum; subalar region of mesopleuron with a smooth glabrous area posteriorly, more pronounced in species of *Khoikhoia*; notauli impressed, crenulate and meeting posteriorly where they generally extend to the transscutal articulation; transscutal articulation complete and depressed; postscutellar depression well developed, more so in *Khoikhoia*; propodeum mostly rugose with median longitudinal carina; epicnemial carina absent; tarsal claws simple; hind tarsomeres lacking longitudinal ridge of setae; hind basitarsus and to a lesser degree some other hind tarsomeres laterally compressed; apical abscissa of Rs of forewing decurved and not tracheated; forewing 1a crossvein long and strong; forewing 2a crossvein absent; forewing 1cu-a far apical to M; forewing 2cu-a absent; forewing 2nd submarginal cell quadrate, tapering apically with r-m crossvein mostly unsclerotized; hindwing crossvein r long but not tubular; hindwing r-m absent.

Metasoma. Median tergite 1 with a median longitudinal groove; laterotergite 1 membranous (or absent according to Mason's 1983 interpretation) and with microstriae, spiracle on laterotergite 1; hypopygium size variable from more than half length of metasoma to approximately 1/5 length of metasoma; ovipositor length variable from barely exserted to almost as long as the metasoma; setae of ovipositor sheath sometimes restricted to apex where they can be very long, e.g., *K. anthelion*.

Distribution. Restricted to the Western, Eastern and Northern Cape Provinces of South Africa, in localities varying from sea level to 1000 meters. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&subfamily=Khoikhoiinae.

Biodiversity. Including the new species proposed here, there are 13 species of Khoikhoiinae. Based on morphological evidence, most of these seem quite distinct, although *K. turneri* and *K. townesi* may constitute one species. Nonetheless, there are undoubtedly many more species. Of the seven species of *Khoikhoia*, all but two are represented by one specimen, and the two exceptions are known from two specimens. Two of these species were collected during intensive programs of Malaise trap sampling at two localities spanning a couple of years suggesting that in contrast to *Sania*, *Khoikhoia* species may be rare. Malaise traps seem effective in capturing specimens, and further intensive Malaise trap sampling targeting under-collected habitats in the Cape and perhaps other areas of southern Africa will undoubtedly result in the discovery of many more species.

Hosts. Unknown, probably larval Lepidoptera (See Life History section above).

Khoikhoia Mason, 1983

Type species: *Khoikhoia townesi* Mason, 1983

Diagnosis: Clypeus with median and sometimes lateral teeth; mandible large, face rugose to rugosopunctate; subalar area of mesopleuron with vertical carina weak or absent, and with posterior convex smooth glabrous area.

Distribution: Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Khoikhoia

Etymology: "The genus name is feminine, dedicated to the original inhabitants of the South African cape region, the Khoikhoi, who were known to the Dutch settlers as Hottentots because of their unique clicking speech." (Mason 1983: p. 53).

Species Descriptions of Khoikhoiinae

Khoikhoia anthelion Sharkey, sp. n.

urn:lsid:zoobank.org:act:D613345A-984A-4DEF-89AA-C5A91BD6FA84

Holotype female. Body. Length. 6.8 mm. Color. Mostly black with laterotergite 1 pale and the following areas yellowish brown: gena, posterodorsal apex of pronotum, tegula, legs except coxae, trochanters, and some tarsomeres (Fig. 4A–C). Forewing mostly weakly infuscate but less so anterobasally and at midlength (Fig. 5E). <Male paratype very similar to holotype, with somewhat more extensive yellowish brown color on the pronotum.> Head. Number of flagellomeres 29 <29–30>. Scape flared apicoanteriorly with expanded apical surface (Fig. 3C). Antennal scrobe shallow (Fig. 3C); rugose medially, smooth laterally except with few transverse striae immediately posterad antennal insertion (Fig. 3C). Gena with wide irregular punctures, lacking distinct rugose striae (Fig. 5A). Face entirely rugose (Fig. 4E). Area between antennal scrobe and inner orbit of eye with weak protuberance (Fig. 4E). Vertex with strong coarse punctures (Fig. 4F). Posterior orbit of eye with distinct crenulate margin (Fig. 5A). Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 4D). Notauli entirely crenulate (Fig. 4D). Mesopleuron entirely rugosopunctate or rugose (Figs. 3D, 4C). Sternaulus long, occupying most of length of mesopleuron, indicated by vertically elongated crenulae (Figs. 3D, 4C). Discrimen (median longitudinal ventral sulcus between mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly punctate area (Fig. 4C). Propodeum entirely rugose without smooth area posterolaterally (Fig. 5C). Metasoma. Median tergite 1 not distinctly narrowed posteriorly (Figs. 2A, 5C), completely rugose (Figs. 2A, 5C). Hypopygium less than 1/3 length of metasoma (Fig. 5D); extending past apical tergum (Fig. 5D). Ovipositor barely exserted, much shorter than metasoma (Figs. 2F, 5D). Length of setae of ovipositor sheath as much as 4x as long as width of sheath (Figs. 2F, 5D).

Male. Antenna highly sexually dimorphic with the female antennae shorter and tapering much more rapidly than those of male.

Diagnosis. Mesopleuron entirely rugosopunctate or rugose (Fig. 4C); middle lobe of scutum entirely smooth with punctures (Fig. 4D).

Material Examined. Holotype female: South Africa, Western Cape, Kogelberg Nature Reserve, MT, KO98-M42, Mesic Mtn. Fynbos, last burnt c. 1988, 34°16.481'S, 19°01.033'E, 199m, 16.IX-16.X.1999, S. van Noort. SAM-HYM-P0024705 (SAMC)

Paratype. Male same data as holotype (HIC).

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Khoikhoia&species=anthelion.

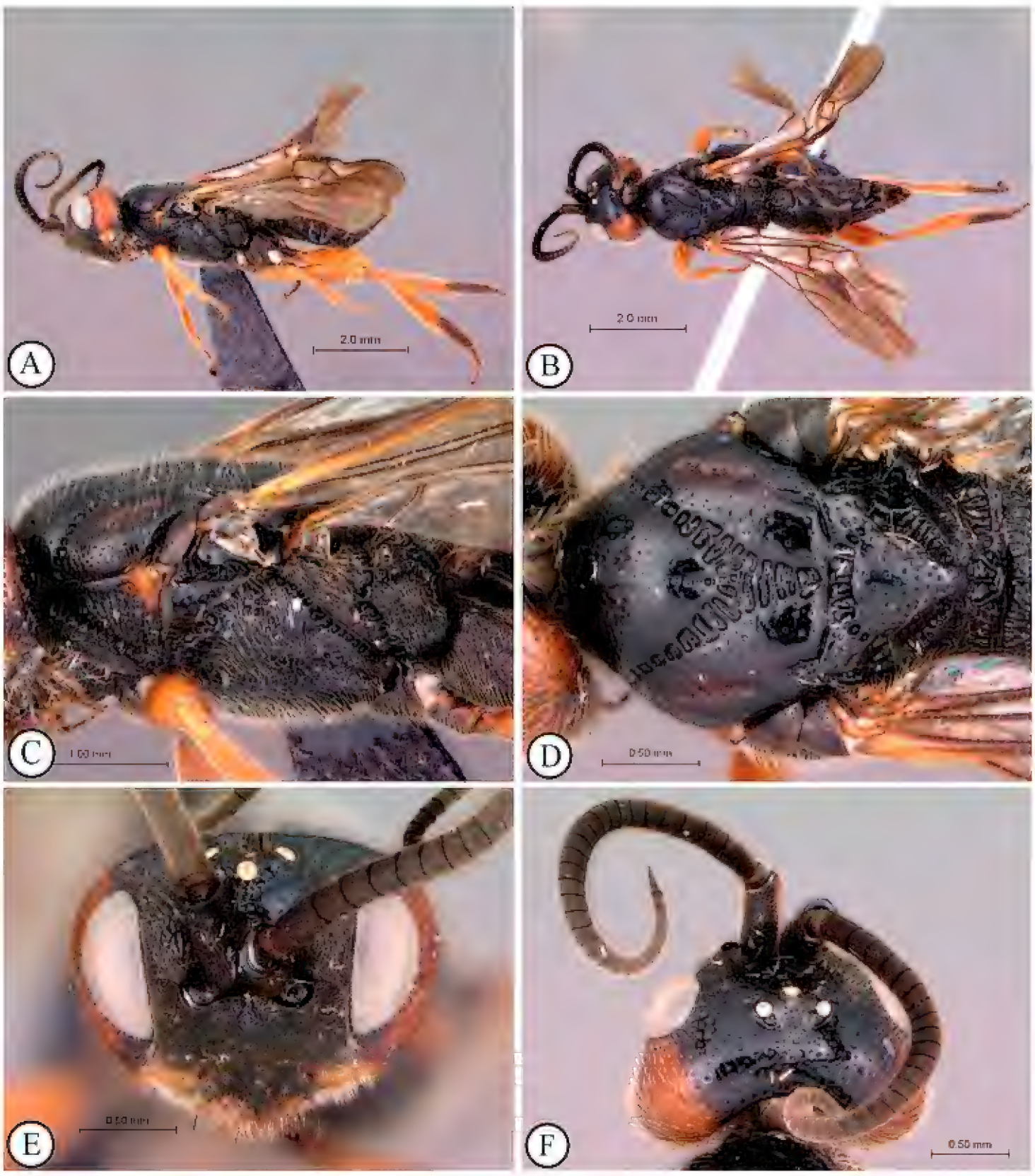


Figure 4. *Khoikhoia anthelion* Sharkey, sp. n., female, holotype **A** habitus, lateral view **B** habitus, dorsal view **C** mesosoma, lateral view **D** mesosoma, dorsal view **E** head, anterior view **F** head, dorsal view.

Etymology. *Anthelion* (Greek) is the diminutive of *anthele*, tuft or plume of a reed. The name refers to the unique tuft of setae on the ovipositor sheaths.

Khoikhoia lission Mason, 1984

Holotype female. Body Length. 4.7 mm. Color. Mottled dark brown and yellowish brown except laterotergite 1 whitish, otherwise metasoma mostly pale brown, head and

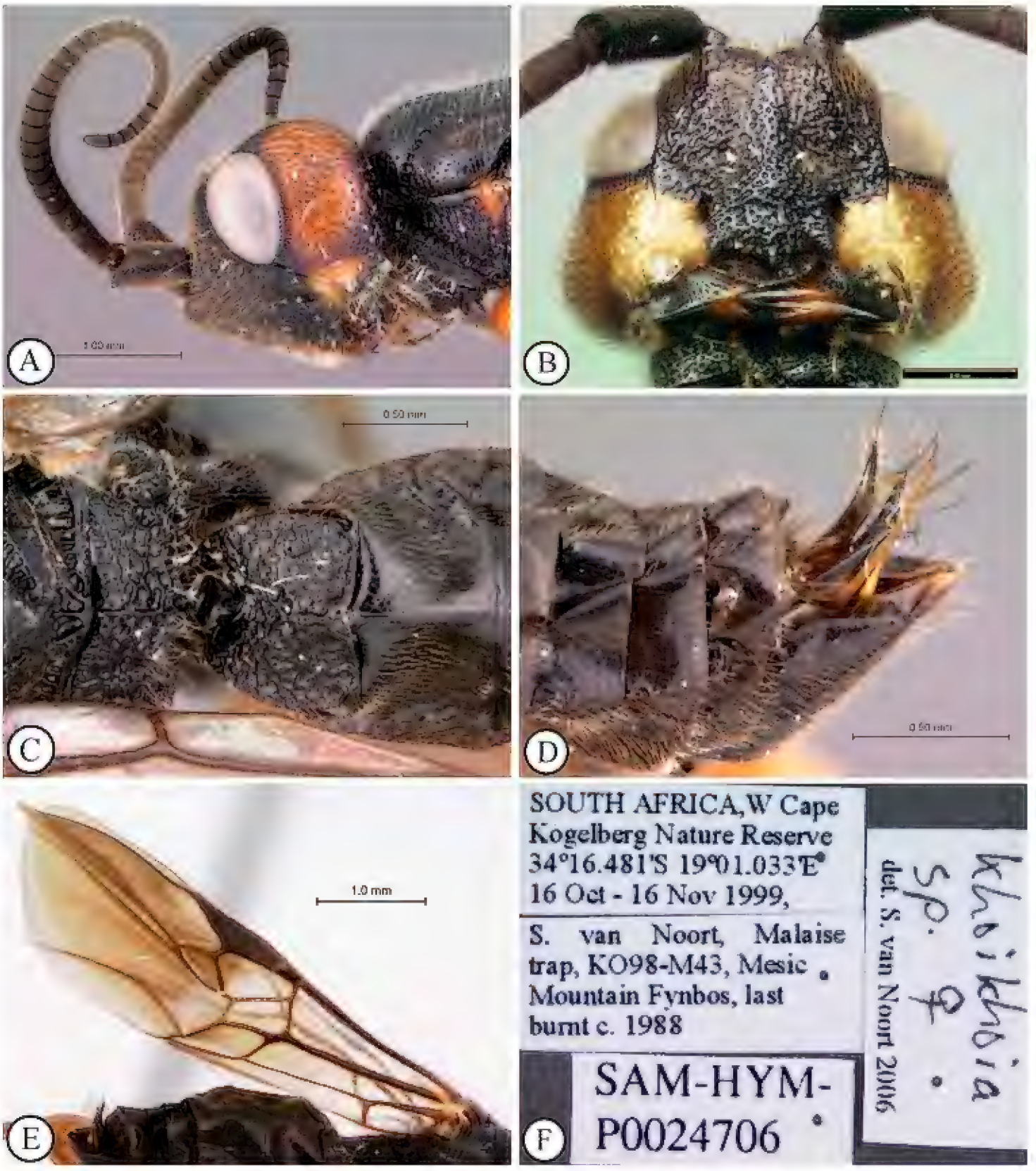


Figure 5. *Khoikhoia anthelion* Sharkey, sp. n., female, holotype **A** head, lateral view **B** head, anterior view **C** propodeum, metasomal tergites, dorsal view **D** ovipositor, lateral view **E** wings **F** data labels.

mesothorax predominantly yellowish brown (Fig. 6). Forewing entirely infuscate (Fig. 7E). Head. Number of flagellomeres 34. Scape flared apicoanteriorly with expanded apical surface. Antennal scrobe deep (Fig. 7B); entirely transversely rugosostriate. Gena transversely rugosostriate anteriorly, rugosopunctate at midlength, longitudinally rugosostriate posteriorly (Fig. 7B). Face entirely rugose (Fig. 7A). Area between antennal scrobe and inner orbit of eye with protuberance (Fig. 7A). Vertex with weak punctures (Fig. 7B). Posterior orbit of eye with distinct crenulate margin (Fig. 7B). Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 7C). Notauli entirely crenu-

Figure 6. *Khoikhoia lission* Mason, 1984, female, holotype **A** habitus, dorsal view **B** habitus, lateral view **C** head, mesosoma, lateral view.

late (Fig. 7C). Mesopleuron at least partly smooth with punctures (Fig. 6C). Sternaulus weakly indicated by a slight depression, not differentially sculptured (Fig. 6C) <this is likely to be variable>. Discrimen (median longitudinal ventral sulcus between mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly punctate area (Fig. 6C). Propodeum entirely rugose without smooth area posterolaterally (Fig. 7C). Metasoma. Median tergite 1 not distinctly narrowed posteriorly (Fig. 7D), completely rugose but with rugae weak posterolaterally (Fig. 7D).

Diagnosis. Mesopleuron at least partly smooth with punctures (Fig. 6C); notauli entirely crenulate; mesosoma partly or entirely brown; median tergite 1 completely rugose (Fig. 7C).

Figure 7. *Khoikhoia lission* Mason, 1984, female, holotype **A** head anterior view **B** head, lateral view **C** mesosoma, dorsal view **D** propodeum, metasomal tergites, dorsal view **E** wings **F** data labels

Male. Unknown.

Material Examined. Holotype female: South Africa, Witzenberg Vall., S.W. Cape Prov., 914m, 19.I.1921, R.E. Turner (BMNH).

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Khoikhoia&species=lission.

Etymology. Mason (1984) did not include the etymology but the interpretation seems rather straightforward. *Lission* (Greek) is the diminutive of *lissos*, meaning smooth or polished and referring to the mesosoma which is smooth relative to other members of the genus.

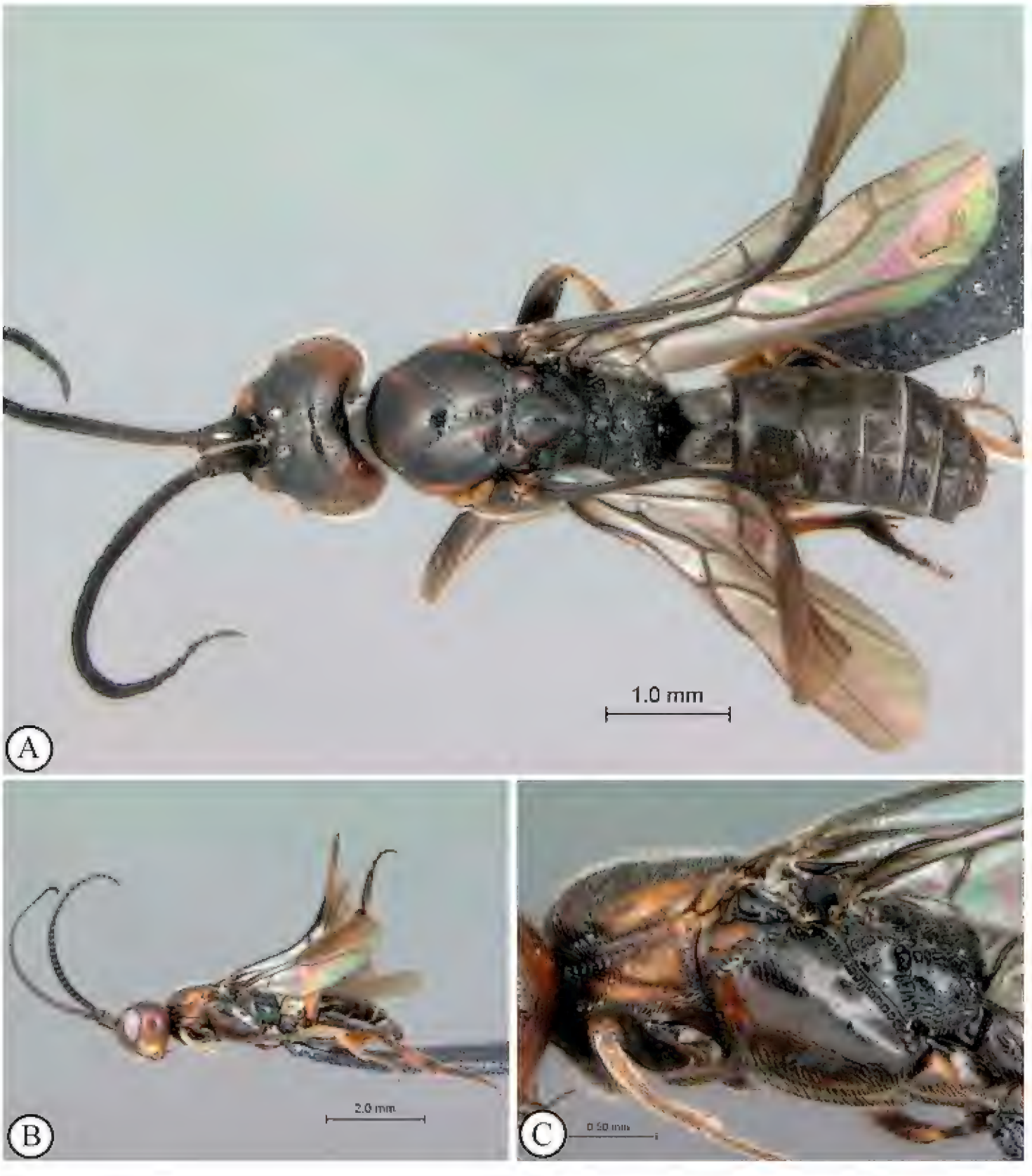


Figure 8. *Khoikhoia oligospilos* Sharkey, sp. n., male, holotype **A** habitus, dorsal view **B** habitus, lateral view **C** mesosoma, lateral view.

***Khoikhoia oligospilos* Sharkey, sp. n.**
urn:lsid:zoobank.org:act:55AB2D05-C992-4B88-A7C3-B93E6BCD70A4

Holotype male. Body. Length. 6.0 mm. Color. Mottled black and brown except laterotergite 1 whitish, otherwise metasoma mostly brown (Fig. 8). Forewing mostly weakly infuscate but less so anterobasally and at midlength (Fig. 8A). Head. Number of flagellomeres 31. Scape flared apicoanteriorly with expanded apical surface (Fig. 9B). Antennal scrobe deep (Fig. 9E); entirely transversely rugosostriate, somewhat

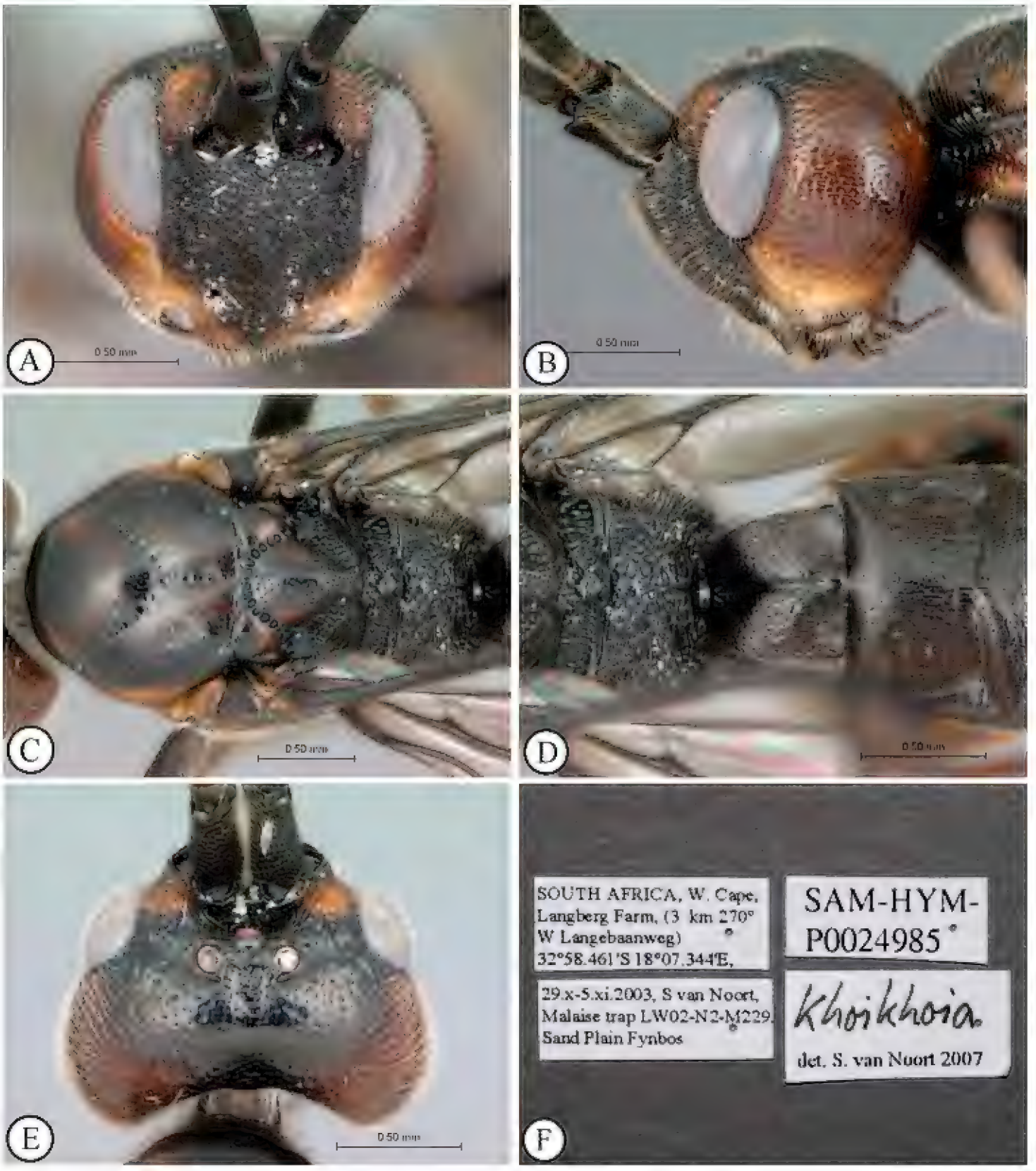


Figure 9. *Khoikhoia oligospilos* Sharkey, sp. n., male, holotype **A** head anterior view **B** head, lateral view **C** mesosoma, dorsal view **D** propodeum, metasomal tergites, dorsal view **E** head, dorsal view **F** data labels.

smoother dorsomedially. Gena with wide irregular punctures, lacking distinct rugose striae (Fig. 9B). Face entirely rugose (Fig. 9A). Area between antennal scrobe and inner orbit of eye with protuberance (Fig. 9A). Vertex with weak punctures (Fig. 9E). Posterior orbit of eye with distinct crenulate margin (Fig. 9B). Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 9C). Notauli crenulations weak and partly effaced (Fig. 9C). Mesopleuron at least partly smooth with punctures (Fig. 8C). Sternaulus absent (Fig. 8C). Discrimen (median longitudinal ventral sulcus between mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly punctate area, or partly rugose but with a large smooth lightly punctate area. Propodeum entirely rugose without smooth area posterolaterally (Fig. 9D). Metasoma. Median tergite 1 not distinctly narrowed posteriorly (Fig. 9D), partly smooth with punctures especially posteriorly, with weak rugae or microsculpture anteriorly (Fig. 9D).

Female. Unknown.

Diagnosis. Notaular crenulations weak and partly effaced (Fig. 9C).

Material Examined. Holotype female: South Africa, Western Cape, Langberg Farm, 3 km 270° W Langebaanweg, MT, LW02-N2-M229, Sand Plain Fynbos, 32°58.461'S, 18°07.344'E, 51m, 29.X-5.XI.2003, S. van Noort. SAM-HYM-P0024985 (SAMC).

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Khoikhoia&species=oligospilos.

Etymology. *Oligo-* is from the Greek, *oligos* meaning few, and *spilos* meaning spot. The name refers to the reduction of crenulae on the notauli.

Khoikhoia semiadusta Mason, 1983

Holotype male. Body. Length. 7.0 mm. Color. Mostly black with reddish brown infusions on temple, lateral frons, tegula, and parts of legs; laterotergite 1 whitish; lower gena and malar space yellowish white (Fig. 10). Forewing clear basally, infuscate in apical half (Fig. 11E). Head. Number of flagellomeres 37. Scape flared apicoanteriorly with expanded apical surface (Fig. 11B). Antennal scrobe deep (Fig. 11B); entirely transversely rugosostriate. Gena entirely longitudinally rugosostriate, striae weaker posteriorly (Fig. 11B). Face entirely rugose (Fig. 11A). Area between antennal scrobe and inner orbit of eye with protuberance (Fig. 11A). Vertex with strong coarse punctures (Fig. 10A). Posterior orbit of eye with distinct crenulate margin (Fig. 11B). Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 11C). Notauli entirely crenulate (Fig. 11C). Mesopleuron at least partly smooth with punctures (Fig. 10C). Sternaulus weakly indicated at midlength with slightly deeper sculpture (Fig. 10C). Discrimen (median longitudinal ventral sulcus between mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly punctate area. Propodeum entirely rugose without smooth area posterolaterally (Fig. 11C). Metasoma. Median tergite 1 not distinctly narrowed posteriorly (Fig. 11D), completely rugose (Fig. 11D).

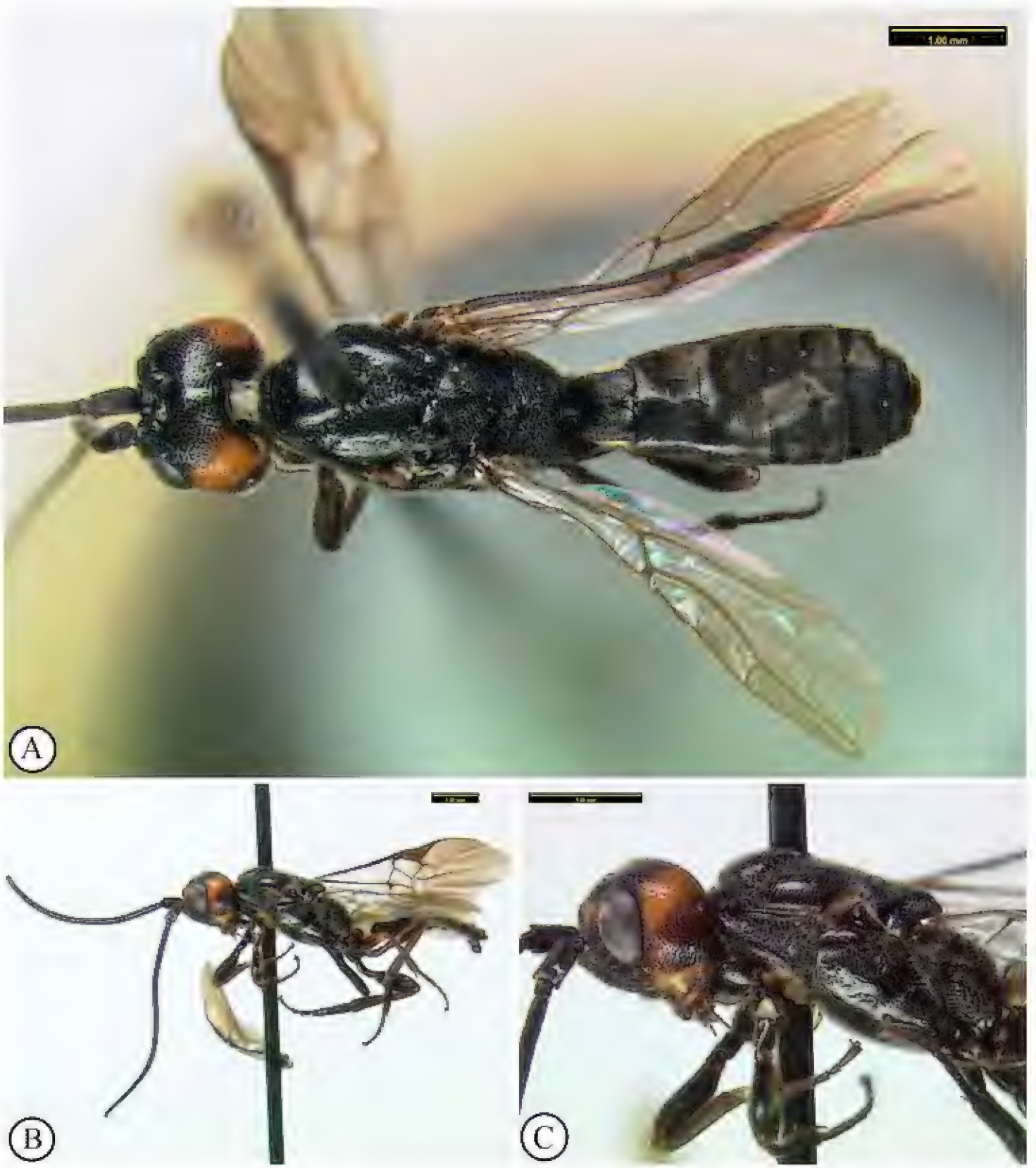


Figure 10. *Khoikhoia semiadusta* Mason, 1983, male, holotype **A** habitus, dorsal view **B** habitus, lateral view **C** head, mesosoma, lateral view.

Female. Unknown.

Diagnosis. Body of mesosoma entirely black except tegula brown (Fig. 10).

Material Examined. Holotype male: South Africa: Jonkershoek, near Stellenbosch, 33°57'33.74"S, 18°55'10.23"E, 227m, 24.XII.1970 , V. Whitehead (AEI).

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Khoikhoia&species=semiadusta.

Etymology. "From the Latin meaning half tanned by the sun in reference to the wings, which are brown apically and hyaline basally." (Mason 1983: p. 55).

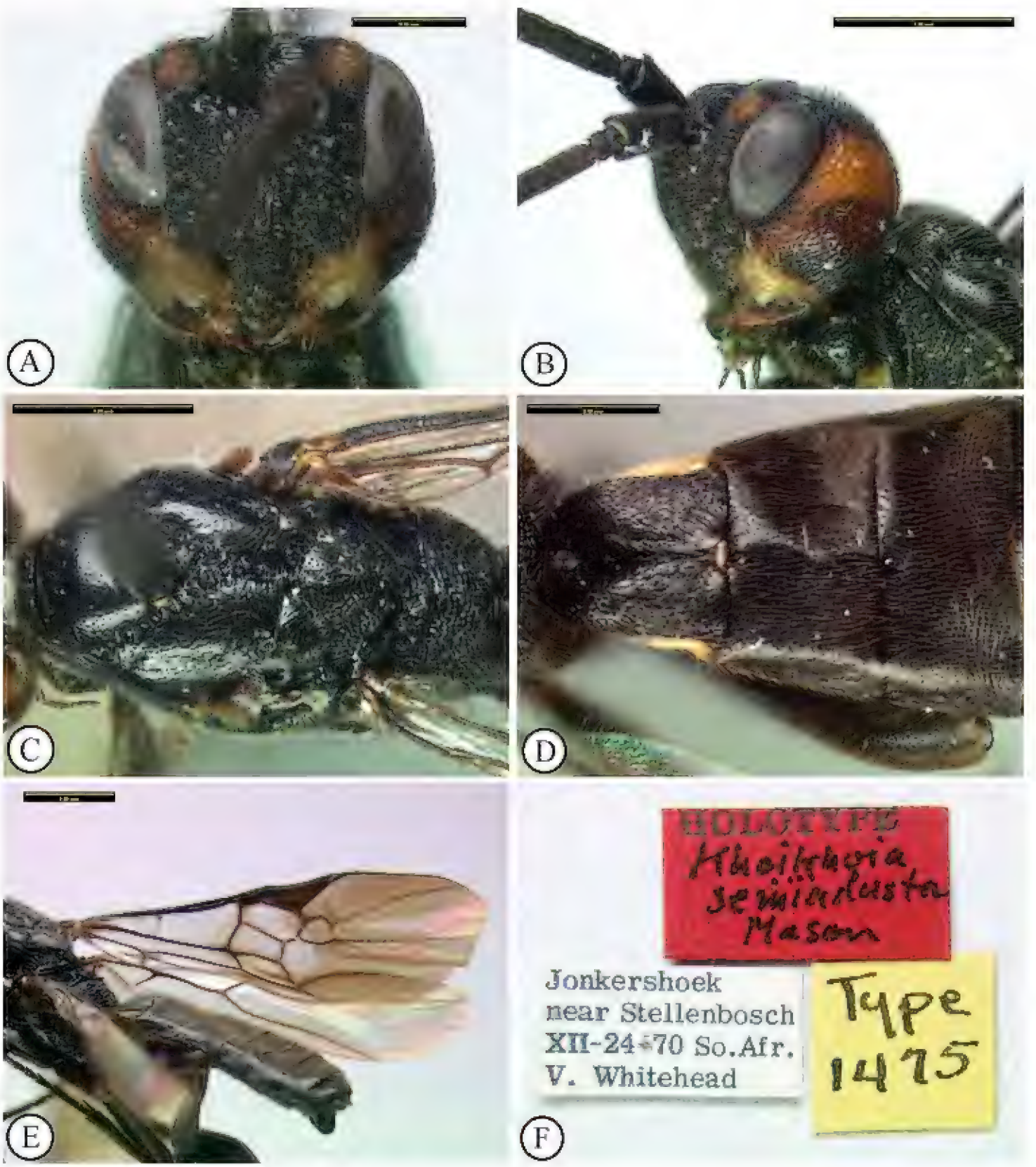


Figure 11. *Khoikhoia semiadusta* Mason, 1983, male, holotype **A** head anterior view **B** head, lateral view. **C** mesosoma, dorsal view **D** metasomal tergites, dorsal view **E** wings **F** data labels.

Khoikhoia solata Mason, 1983

Holotype male. Body. Length. 7.2 mm. Color. Mottled black and brown, except laterotergite 1 whitish, otherwise metasoma mostly brown with some pale yellowish-brown areas on mesosoma and ventral gena (Fig. 12). Forewing entirely infuscate (Fig. 13E). Head. Number of flagellomeres 32 <32–33>. Scape flared apicoanteriorly with expanded apical surface (Fig. 13A, B). Antennal scrobe deep (Fig. 13B); entirely transversely rugososstriate (Fig. 13B). Gena entirely longitudinally rugosos-

triate, striae weaker posteriorly (Fig. 13A, B). Face entirely rugose (Fig. 13A). Area between antennal scrobe and inner orbit of eye with protuberance (Fig. 13A). Vertex with weak punctures (Fig. 12A). Posterior orbit of eye with distinct crenulate margin (Fig. 13B). Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 13C). Notauli entirely crenulate (Fig. 13C). Mesopleuron at least partly smooth with punctures (Fig. 12C). Sternaulus absent or difficult to discern due to dense sculpture of mesopleuron (Fig. 12C). Discrimen (median longitudinal ventral sulcus between mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly

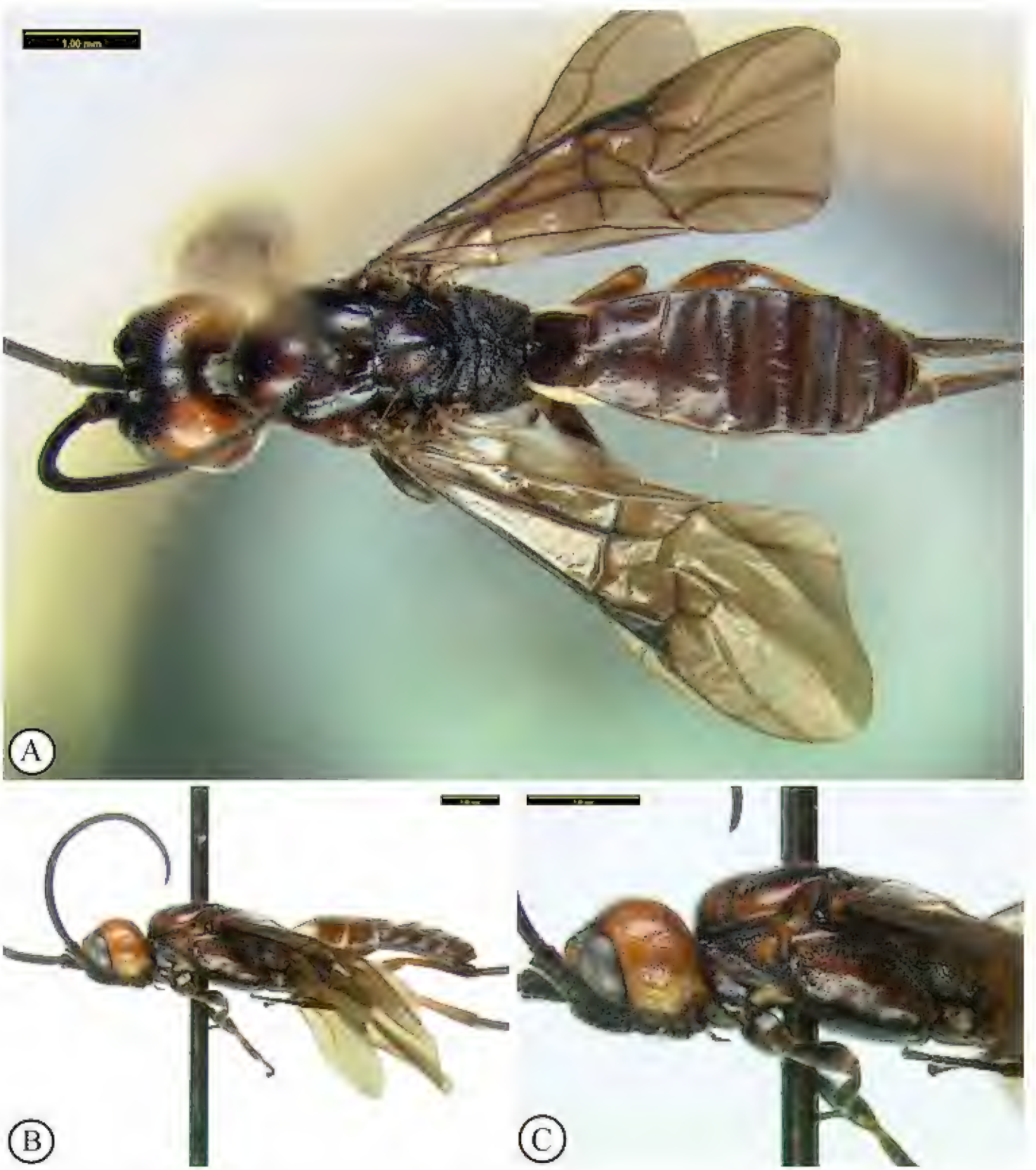


Figure 12. *Khoikhoia solata* Mason, 1983, male, holotype **A** habitus, dorsal view **B** habitus, lateral view. **C** head, mesosoma, lateral view.

punctate area (Fig. 12C). Propodeum entirely rugose without smooth area posterolaterally (Fig. 13C, D). Metasoma. Median tergite 1 not distinctly narrowed posteriorly (Fig. 13D), partly smooth with punctures especially posteriorly, with weak rugae or microsculpture anteriorly (Fig. 13D).

Female. Unknown.

Diagnosis. Tergite 1 partly smooth with punctures posteriorly (Fig. 13D); notauli entirely crenulate (Fig. 13C).

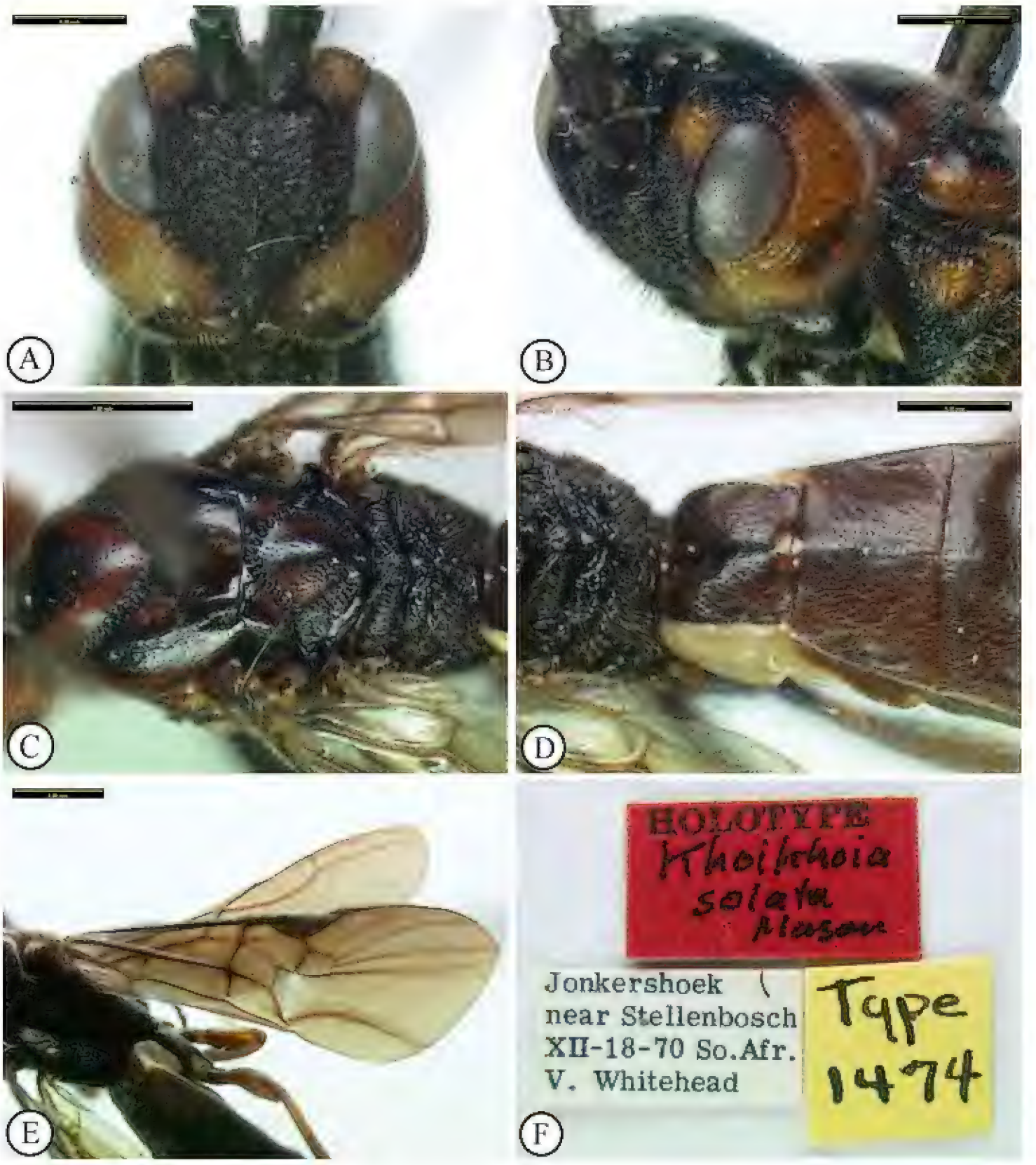


Figure 13. *Khoikhoia solata* Mason, 1983, male, holotype **A** head anterior view **B** head, lateral view **C** mesosoma, dorsal view **D** propodeum, metasomal tergites, dorsal view **E** wings **F** data labels.

Material Examined. Holotype male: South Africa: Jonkershoek, near Stellenbosch, 33°57'33.74"S, 18°55'10.23"E, 227m, 18.XII.1970, V. Whitehead (AEI).

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Khoikhoia&species=solata.

Etymology. "From Latin meaning sunburned, an allusion to the color and to the fully infuscated wings." (Mason 1983: p. 54).

Figure 14. *Khoikhoia townesi* Mason, 1983, female, holotype **A** habitus, dorsal view **B** habitus, lateral view **C** head, mesosoma, lateral view.

Khoikhoia townesi Mason, 1983

Holotype female. Body Length. 6.4 mm. Color. Mottled dark brown and yellowish brown except laterotergite 1 and margins of most metasomal sclerites whitish, head and mesothorax predominantly yellowish brown (Fig. 14). Forewing mostly weakly infuscate but less so anterobasally and at midlength (Fig. 15E), or clear basally, infuscate in apical half. Head. Number of flagellomeres 35 <31–39>. Scape flared apicoanteriorly with expanded apical surface (Fig. 15B). Antennal scrobe deep (Fig. 15B); entirely transversely rugosostriate. Gena transversely rugosostriate anteriorly, longitu-

Figure 15. *Khoikhoia townesi* Mason, 1983, female, holotype **A** head anterior view **B** head, lateral view **C** mesosoma, dorsal view **D** propodeum, metasomal tergites, dorsal view **E** wings **F** data labels.

dinally rugososstriate posteriorly (Fig. 15A, B). Face entirely rugose (Fig. 15A). Area between antennal scrobe and inner orbit of eye with protuberance (Fig. 15A). Vertex with strong coarse punctures (Fig. 14A). Posterior orbit of eye with distinct crenulate margin (Fig. 15B). Mesosoma. Middle lobe of scutum entirely rugosopunctate (Fig. 15C). Notauli entirely crenulate (Fig. 15C). Mesopleuron entirely rugosopunctate or rugose (Fig. 14C). Sternaulus absent or difficult to discern due to dense sculpture of mesopleuron (Fig. 14C). Discrimen (median longitudinal ventral sulcus between mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly punctate area (Fig. 14C). Propodeum entirely rugose without smooth area posterolaterally (Fig. 15C, D). Metasoma. Median tergite 1 not distinctly narrowed posteriorly (Fig. 15D); completely rugose (Fig. 15D). Hypopygium less than 1/3 length of metasoma (Fig. 1F, 14B); not extending past apical tergum (Fig. 1F, 14B). Ovipositor barely exserted, much shorter than metasoma (Fig. 1F, 14B). Setae of ovipositor sheath not longer than 2× width of ovipositor sheath (Fig. 1F).

Male. Unknown.

Diagnosis. Middle lobe of scutum entirely rugosopunctate (Fig. 15C); mesopleuron entirely rugosopunctate (Fig. 14C). *Khoikhoia townesi* is very similar to *K. turneri*, and may be a senior synonym. The only appreciable differences are slight sculptural differences on the face and the middle lobe of the mesoscutum, and rather slight color differences (see figure associated with couplet 5 in the key).

Material Examined. Holotype female: South Africa, Grahamstown, 33°18'37.50"S, 26°31'30.22"E, 545m, II.1972, Fred Gess (AEI).

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Khoikhoia&species=townesi. The sole specimen of this species, together with the single specimen of *Sania henryi* (Northern Cape Province) are the only representatives of Khoikhoiinae collected outside of the Western Cape Province. Like its congeners, *Khoikhoia townesi* is probably still associated with Fynbos, as Grahamstown lies at the extreme eastern limits of this biome.

Etymology. Although not specified in Mason (1983), this is a patronym for Henry Townes.

Khoikhoia turneri Mason, 1984

Holotype female. Body. Length. 6.8 mm. Color. Mottled black and brown except laterotergite 1 whitish, body, particularly metasoma, predominantly dark brown to black (Fig. 16). Forewing entirely infuscate (Fig. 17E). Head. Number of flagellomeres 34 <30–38>. Scape flared apicoanteriorly with expanded apical surface (Fig. 17B). Antennal scrobe deep (Fig. 17B); entirely transversely rugososstriate. Gena entirely longitudinally rugososstriate, striae weaker posteriorly (Fig. 17A). Face entirely rugose (Fig. 17A). Area between antennal scrobe and inner orbit of eye with protuberance (Fig. 17A). Vertex with strong coarse punctures (Fig. 16A). Posterior orbit of eye

with distinct crenulate margin (Fig. 17B). Mesosoma. Middle lobe of scutum smooth with punctures anteromedially, otherwise rugosopunctate (Fig. 17C). Notauli entirely crenulate (Fig. 17C). Mesopleuron entirely rugosopunctate or rugose (Fig. 16C). Sternaulus absent or difficult to discern due to dense sculpture of mesopleuron (Fig. 16C). Discrimen (median longitudinal ventral sulcus between mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly punctate area (Fig. 16C). Propodeum entirely rugose without smooth area posterolaterally (Fig. 17D). Metasoma. Median tergite 1 not distinctly narrowed posteriorly (Fig. 17D); completely

Figure 16. *Khoikhoia turneri* Mason, 1984, female, holotype **A** habitus, dorsal view **B** habitus, lateral view. **C** head, mesosoma, lateral view.

rugose (Fig. 17D). Hypopygium less than 1/3 length of metasoma (Fig. 1E, 16B); not extending past apical tergum (Fig. 1E, 16B). Ovipositor barely exserted, much shorter than metasoma (Fig. 1E, 16B). Setae of ovipositor sheath not longer than 2× width of ovipositor sheath (Fig. 1E).

Male. Unknown.

Diagnosis. Middle lobe of scutum smooth with punctures anteromedially, otherwise rugosopunctate (Fig. 17C); mesopleuron entirely rugosopunctate (Fig. 16C).

Material Examined. Holotype female: South Africa, Ceres, Cape Province, 33°22'14.08"S, 19°18"22.10"E, 457m, I.1921, R.E.Turner (BMNH).

Figure 17. *Khoikhoia turneri* Mason, 1984, female, holotype **A** head anterior view **B** head, lateral view. **C** mesosoma, dorsal view **D** propodeum, metasomal tergites, dorsal view **E** wings **F** data labels.

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Khoikhoia&species=turneri.

Etymology. Although not specified in Mason (1984), this is a patronym for R. Turner, the collector of the holotype.

Sania Mason, 1983

Type species. *Sania marjoriae* Mason, 1983

Diagnosis. Clypeus weakly concave, lacking teeth; face smooth to weakly punctate; subalar area of mesopleuron with strong vertical carina, and with posterior flat smooth to weakly convex glabrous area, not nearly as well developed as that of *Khoikhoia*.

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Sania.

Etymology. "A feminine generic name, dedicated to the San people, a few of whom still follow their ancient hunting life in remote and arid parts of southern Africa." (Mason 1983: p. 51).

Sania browni Sharkey, sp. n.

urn:lsid:zoobank.org:act:035CFE8B-7302-4940-A085-1A58E9E99762

Holotype female. Body Length. 3.5 mm <3.4 – 4.4 mm>. Color. Mostly yellowish brown except as follows: head mostly black except ventrally; mesosoma including legs with most sclerites with some black infusions; metasoma mostly brownish black, with lateral areas of terga yellowish white, and pleural area of tergum 1 white; ovipositor sheath white basally, brown apically; <quite variable, from mostly black to mostly yellowish brown (Fig. 18); mesosoma always with extensive orangish brown; differing from most other species in that all specimens have extensive pale whitish yellow on all lateral terga (Fig. 18A)>. Forewing entirely infuscate (Fig. 19E). Head. Number of flagellomeres, 23 <23–25>. Scape not flared apicoanteriorly and lacking expanded apical surface (Fig. 18C,F). Antennal scrobe flat (Fig. 18F); entirely smooth with weak punctures. Clypeus mostly smooth with weak punctures (Fig. 18E); without median tooth (Fig. 18E, 19A). Gena mostly smooth with weak punctures (Fig. 18E,F). Face mostly punctate with some weak rugae especially dorsally (Fig. 18E). Area between antennal scrobe and inner orbit of eye without protuberance (Fig. 18E). Vertex with weak punctures (Fig. 18D). Posterior orbit of eye lacking distinct crenulate margin (Fig. 18C). Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 18D). Notauli entirely crenulate (Fig. 18D). Mesopleuron at least partly smooth with punctures (Fig. 18C, 19C). Sternaulus only present at midlength (Figs. 18C, 19C), or absent (Fig. 18C). Discrimen (median longitudinal ventral sulcus between mesopleura) smooth or with a few barely perceptible crenulae (Fig. 19B). Metapleuron partly

rugose but with a large smooth lightly punctate area (Figs. 18C, 19C). Propodeum entirely rugose without smooth area posterolaterally (Figs. 18D, 19D). Metasoma. Median tergite 1 distinctly narrowed posteriorly (Figs. 2B,19D); mostly smooth with few rugae near midlength (Figs. 2B, 19D). Hypopygium less than 1/3 length of metasoma (Figs. 1C, 18A); not extending past apical tergum (Fig. 1C). Ovipositor barely exserted, much shorter than metasoma (Figs. 1C, 18A). Length of setae of ovipositor sheath none longer than 2x width of ovipositor sheath (Fig. 1C).

Male. Antenna not sexually dimorphic.

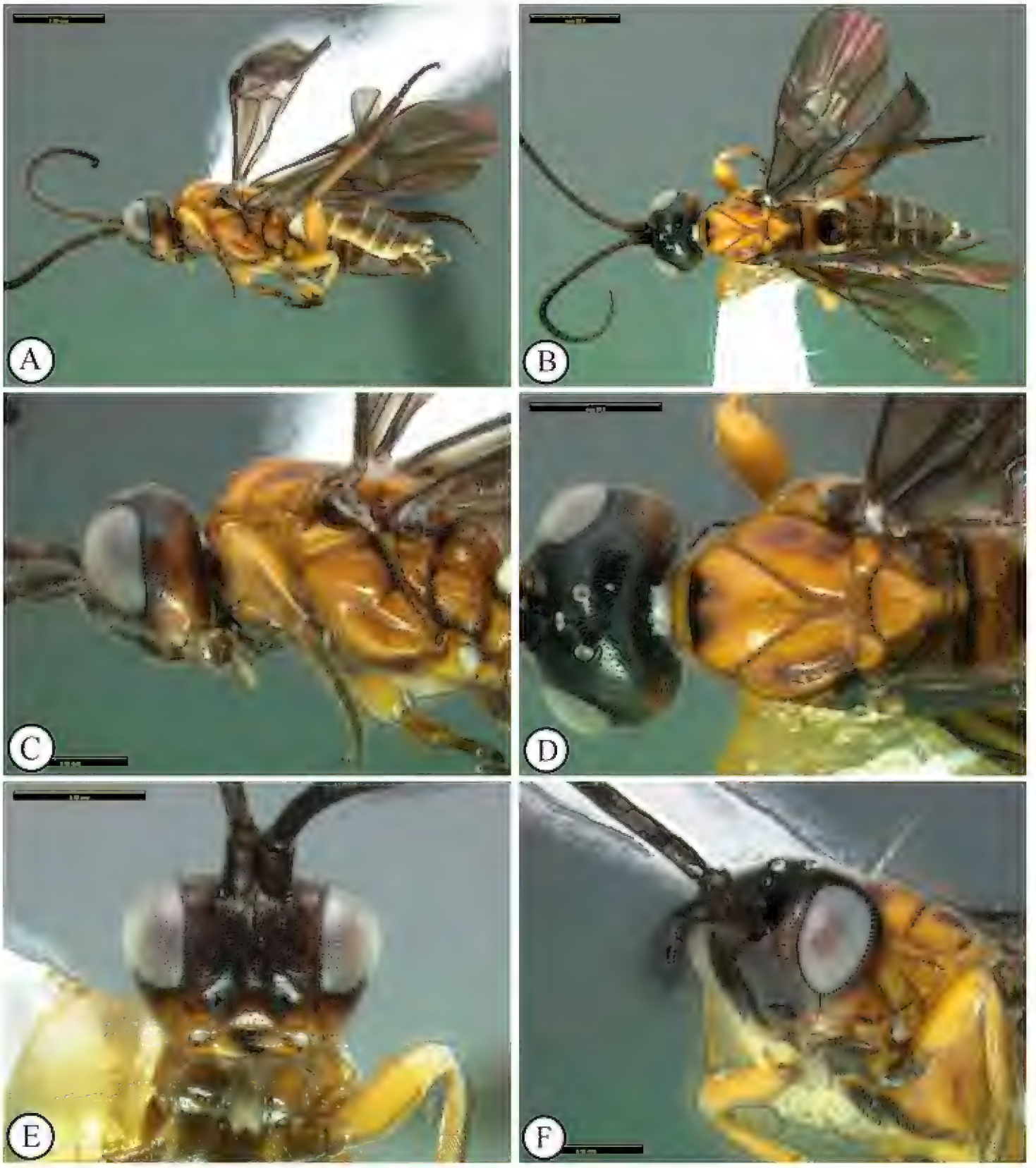


Figure 18. *Sania browni* Sharkey, sp. n., female, paratype **A** habitus, lateral view **B** habitus, dorsal view **C** head, mesosoma, lateral view **D** head, mesosoma, dorsal view **E** head, anterior view **F** head, lateral view.

Diagnosis. Discrimen smooth or with a few barely perceptible crenulae (Fig. 19B); metapleuron partly rugose but with a large smooth lightly punctate area (Fig. 19C).

Material Examined. Holotype Female: South Africa, Western Cape, 15km N Citrusdal, Koedoeskop Farm, Malaise across hillside trail, 32°29'18"S, 18°57'30"E, 220m, 5–25.X.2004, ME Irwin, FD Parker. SA-34 (SAMC)

Paratypes. South Africa, Western Cape: 2 females, 3 males, same data as holotype. 1 female, 9 males, 10 km S. Clanwilliam, Malaise on sandy hill, 32°13'39"S, 18°50'50"E, 140m, 5–25.X.2004, ME Irwin, FD Parker, M Hauser. 2 females, 1 male,

Figure 19. *Sania browni* Sharkey, sp. n., female, paratype **A** head ventral view **B** discrimen **C** mesosoma, lateral view **D** mesosoma & metasoma, dorsal view **E** wings **F** data labels.

14km NW Robertson@hwy R60, Malaise in dry wash, 33°46.65'S 19°45.69'E, 270 m, 7.X.2002, ME Irwin, FD Parker, RSA-15 (SAMC, AEI, HIC, CNCI, INHS).

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Sania&species=browni.

Note: This species is referred to as *Sania* sp. n. 3 in the molecular study by Murphy et al. (2008).

Etymology. Named in honor of Brian Brown, a dipterist of outstanding repute and long time collaborator of the senior author.

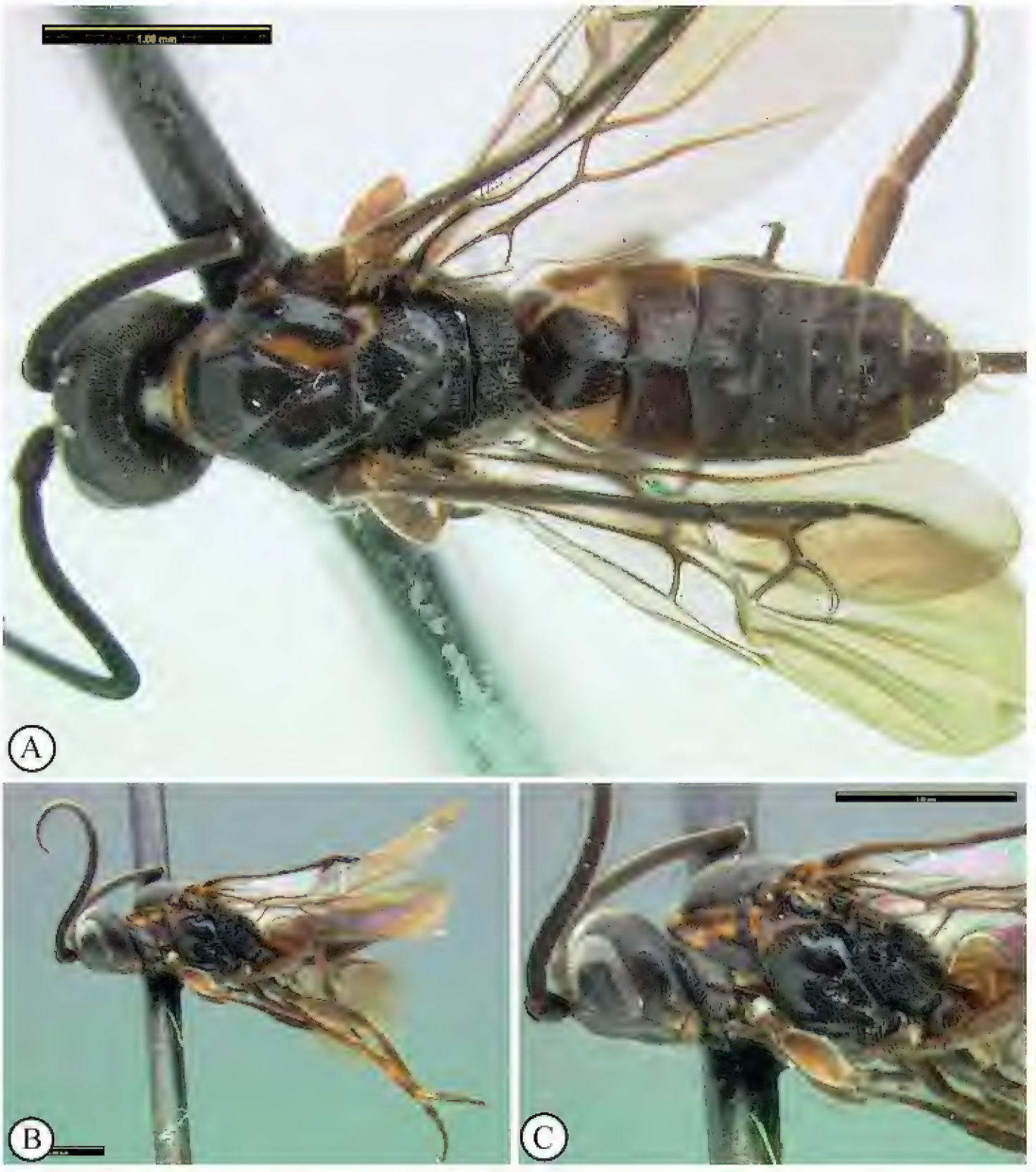


Figure 20. *Sania capensis* Mason, 1983, male, holotype **A** habitus, dorsal view **B** habitus, lateral view **C** head, mesosoma, lateral view.

Sania capensis Mason, 1983

Holotype male. Body Length. 4.0 mm. <4.0–4.1 mm> Color. Mottled black and brown except laterotergite 1 and margins of most metasomal sclerites whitish, left and right sides of the holotype vary considerably with the right side much lighter (Fig. 20). Forewing mostly weakly infuscate, but less so anterobasally and at midlength (Fig. 21E), or clear basally, infuscate in apical half. Head. Number of flagellomeres 26 (23–29). Scape not flared apicoanteriorly and lacking expanded apical surface (Fig. 21B). An-

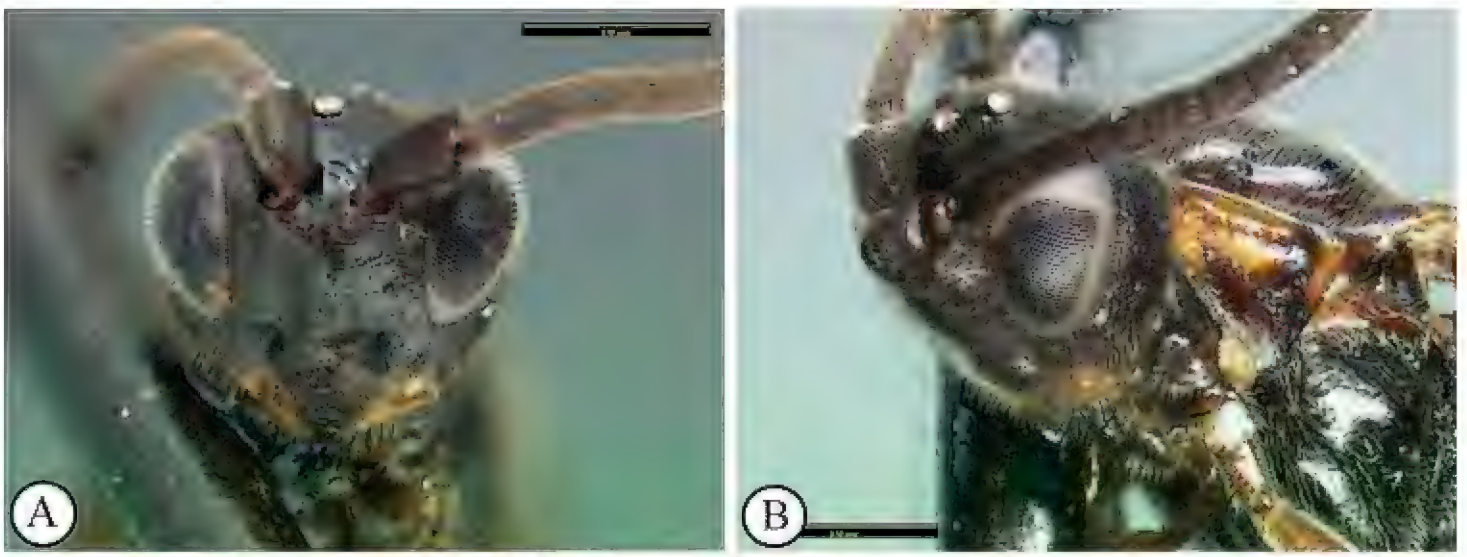


Figure 21. *Sania capensis* Mason, 1983, male, holotype **A** head anterior view **B** head, lateral view **C** mesosoma, dorsal view **D** propodeum, metasomal tergites, dorsal view **E** wings **F** data labels.

tennal scrobe flat (Fig. 21A); smooth with weak punctures medially, weakly and irregularly transverse-striate laterally. Clypeus mostly smooth with weak punctures (Fig. 21A); without median tooth (Fig. 21A). Gena mostly smooth with weak punctures (Fig. 21A). Face weakly punctate throughout (Fig. 21A). Area between antennal scrobe and inner orbit of eye without protuberance (Fig. 21A). Vertex with weak punctures (Fig. 20A). Posterior orbit of eye lacking distinct crenulate margin (Figs. 20C, 21B). Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 21C). Notauli entirely crenulate (Fig. 21C). Mesopleuron at least partly smooth with punctures (Fig. 20C). Sternaulus only present at midlength (Fig. 20C). Discrimen (median longitudinal ventral sulcus between mesopleura) smooth or with a few barely perceptible crenulae. Metapleuron mostly rugose, lacking a large smooth lightly punctate area (Fig. 20C). Propodeum entirely rugose without smooth area posterolaterally (Fig. 21C). Metasoma. Median tergite 1 distinctly narrowed posteriorly (Fig. 21D); partly smooth with punctures especially posteriorly, with weak rugae or microsculpture anteriorly (Fig. 21D).

Female. Unknown.

Diagnosis. Discrimen smooth or with a few barely perceptible crenulae; metapleuron mostly rugose, lacking a large smooth lightly punctate area (Fig. 20C).

Material Examined. Holotype male: South Africa: Jonkershoek, near Stellenbosch, 33°57'33.74"S, 18°55'10.23"E, 227m, 18.XII.1970, V. Whitehead (AEI)

Paratypes. 2 males, South Africa: Jonkershoek, near Stellenbosch, 33°57'33.74"S, 18°55'10.23"E, 227m, 11.I.1971, V. Whitehead (AEI).

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Sania&species=capensis.

Etymology. Not mentioned in Mason (1983), but obviously a reference to the Cape region of South Africa.

Sania henryi Mason, 1983

Holotype male. Body Length. 4.4 mm. Color. Mottled black and brown except laterotergite 1 and margins of most metasomal sclerites whitish, otherwise metasoma mostly brown (Figs. 22A, B). Forewing entirely infuscate (Fig. 22). Head. Number of flagellomeres 24 <20–28>. Scape not flared apicoanteriorly and lacking expanded apical surface (Fig. 23B). Antennal scrobe shallow (Fig. 23B); mostly smooth lacking punctures and microsetae, with very weak irregular sculpture laterally. Clypeus mostly smooth with weak punctures (Fig. 23A); without median tooth (Fig. 23A). Gena with weak rugose microsculpture (Fig. 23A, B). Face mostly punctate with some weak rugae especially dorsally (Fig. 23A). Area between antennal scrobe and inner orbit of eye without protuberance (Fig. 23A). Vertex with weak punctures (Fig. 22A). Posterior orbit of eye with distinct crenulate margin (Figs. 22C, 23B), or lacking distinct crenulate margin. Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 23C). Notauli entirely crenulate (Fig. 23C). Mesopleuron at least partly smooth with punctures (Fig. 22C). Sternaulus long, occupying most of length of mesopleuron (Fig. 22C). Discrimen (median longitudinal ventral sulcus between

mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly punctate area (Fig. 22C), or partly rugose but with a large smooth lightly punctate area (Fig. 22C). Propodeum entirely rugose without smooth area posterolaterally (Fig. 23D). Metasoma. Median tergite 1 distinctly narrowed posteriorly (Fig. 23D); completely rugose (Fig. 23D).

Female. Unknown.

Diagnosis. Scape not flared apicoanteriorly and lacking expanded apical surface (Fig. 23B); discrimen crenulate; mesosoma partly or entirely brown (Fig. 22C).

Material Examined. Holotype male: South Africa, Garies, Cape, 30°33'35.77"S, 17°59'24.91"E, 223m, 23.IX.1970, H. & M. Townes (AEI).

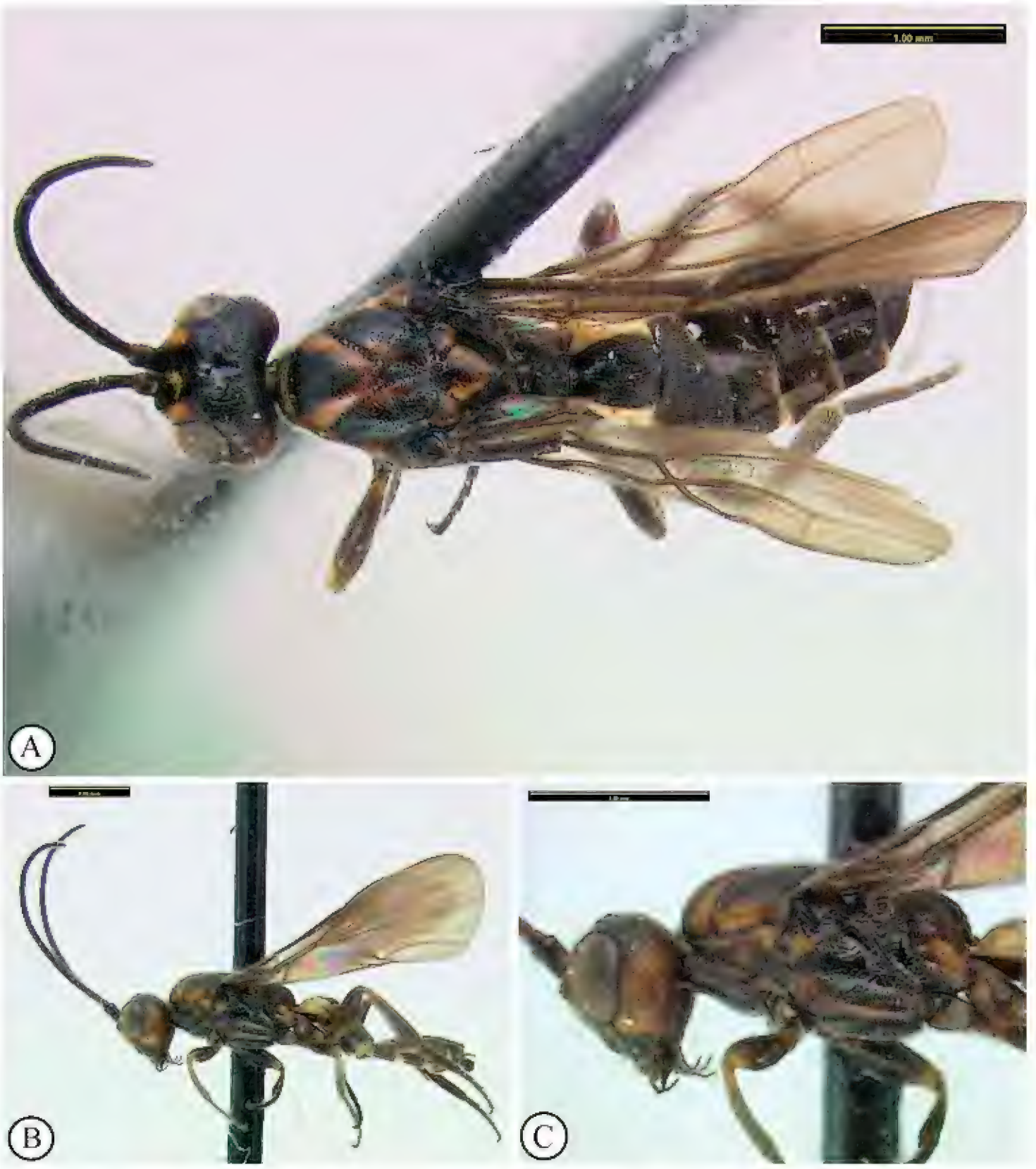


Figure 22. *Sania henryi* Mason, 1983, male, holotype **A** habitus, dorsal view **B** habitus, lateral view **C** head, mesosoma, lateral view.

Figure 23. *Sania henryi* Mason, 1983, male, holotype **A** head anterior view **B** head, lateral view **C** mesosoma, dorsal view **D** propodeum, metasomal tergites, dorsal view **E** wings **F** data labels.

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Sania&species=henryi. Together with the single specimen of *Khoikhoia townesi* (Eastern Cape Province) these are the only two representatives of Khoikhoiinae collected outside of the Western Cape Province. *Sania henryi* is the only Khoikhoiinae so far recorded as being associated with the Succulent Karoo biome, a biodiversity hotspot (Myers et al. 2000). We expect that further undiscovered species will be collected in this habitat.

Etymology. Not mentioned in Mason (1983) but clearly a patronym for Henry Townes.

Sania marjoriae Mason, 1983

Holotype female. Body Length. 4.0 mm <3.4 – 4.0 mm.>. Color. Mostly dark brown to black; mottled black or dark brown and pale brown except laterotergite 1 and margins of most metasomal sclerites whitish, left and right sides of the holotype vary considerably with the right side much lighter (Fig. 24), <the extent of pale brown color varies considerably but dark brown to black always predominates in the examined specimens>. Forewing mostly weakly infuscate but less so anterobasally and at midlength (Fig. 25E), or clear basally, infuscate in apical half. Head. Number of flagellomeres 28 <24 – 28>. Scape flared apicoanteriorly with expanded apical surface (Figs. 3A, 25B). Antennal scrobe shallow (Figs. 3A, 25B), or flat; mostly smooth lacking punctures and microsetae, with very weak irregular sculpture laterally. Clypeus mostly smooth with weak punctures (Fig. 25A); without median tooth (Fig. 25A). Gena with weak rugose microsculpture (Fig. 25A). Face mostly punctate with some weak rugae especially dorsally (Fig. 25A). Area between antennal scrobe and inner orbit of eye without protuberance (Fig. 25A). Vertex with weak punctures (Fig. 24A). Posterior orbit of eye with distinct crenulate margin, or lacking distinct crenulate margin (Fig. 25B). Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 25C). Notauli entirely crenulate (Fig. 25C). Mesopleuron at least partly smooth with punctures (Figs. 3E, 24C). Sternaulus long, occupying most of length of mesopleuron (Figs. 3E, 24C). Discrimen (median longitudinal ventral sulcus between mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly punctate area (Fig. 24C). Propodeum mostly rugose with smooth area posterolaterally (Fig. 25C). Metasoma. Median tergite 1 distinctly narrowed posteriorly (Figs. 2C, 25D) completely rugose (Figs. 2C, 25D). Hypopygium subequal to half length of metasoma (Figs. 1A, 24B); extending past apical tergum (Figs. 1A, 24B). Ovipositor more than half as long as metasoma (Figs. 1A, 24B). Setae of ovipositor sheath 1 to 2× as long as sheath width (Figs. 1A, 24B).

Male. Antenna slightly sexually dimorphic with the female antennae shorter and tapering slightly more rapidly than those of male.

Diagnosis. Scape flared apicoanteriorly with expanded apical surface; median tergite 1 distinctly narrowed posteriorly and completely rugose (Fig. 25D).

Material Examined. Holotype female: South Africa: Jonkershoek, near Stellenbosch, 33°57'33.74"S, 18°55'10.23"E, 227m, 18.XII.1970, V. Whitehead (AEI)

Other specimens. 5 females, 9 males, South Africa: Western Cape, 10 km S. Clanwilliam, Malaise on sandy hill, 32°13'39"S, 18°50'50"E, 140m, 5–25.X.2004, ME Irwin, FD Parker, M Hauser (SAMC, HIC, INHS).

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Sania&species=marjoriae.

Etymology. "Dedicated to Marjorie Townes, whose quiet labors over many years have contributed so greatly to the production of the 'Townes and Townes' team." (Mason 1983: p. 51).

Note. This species is referred to as *Sania* sp. n. 4 in the molecular study by Murphy et al. (2008).

Figure 24. *Sania marjoriae* Mason, 1983, female, holotype **A** habitus, dorsal view **B** habitus, lateral view **C** head, mesosoma, lateral view.

***Sania masneri* Sharkey, sp. n.**
urn:lsid:zoobank.org:act:49E6B48F-F40B-479C-9704-8EDFAE402EB9

Holotype female. Body Length. 5.2 mm <male 4.2. mm>. Color. Mottled black and brown except laterotergite 1 and margins of most metasomal sclerites whitish, otherwise metasoma mostly brown (Fig. 26). Forewing clear basally, infuscate in apical half (Fig. 27E). Head. Number of flagellomeres 28 <male also 28>. Scape flared apicoanteriorly with expanded apical surface (Fig. 27B). Antennal scrobe shallow (Fig. 27B); smooth medially, transversely striate laterally. Clypeus mostly smooth with weak punctures (Fig.

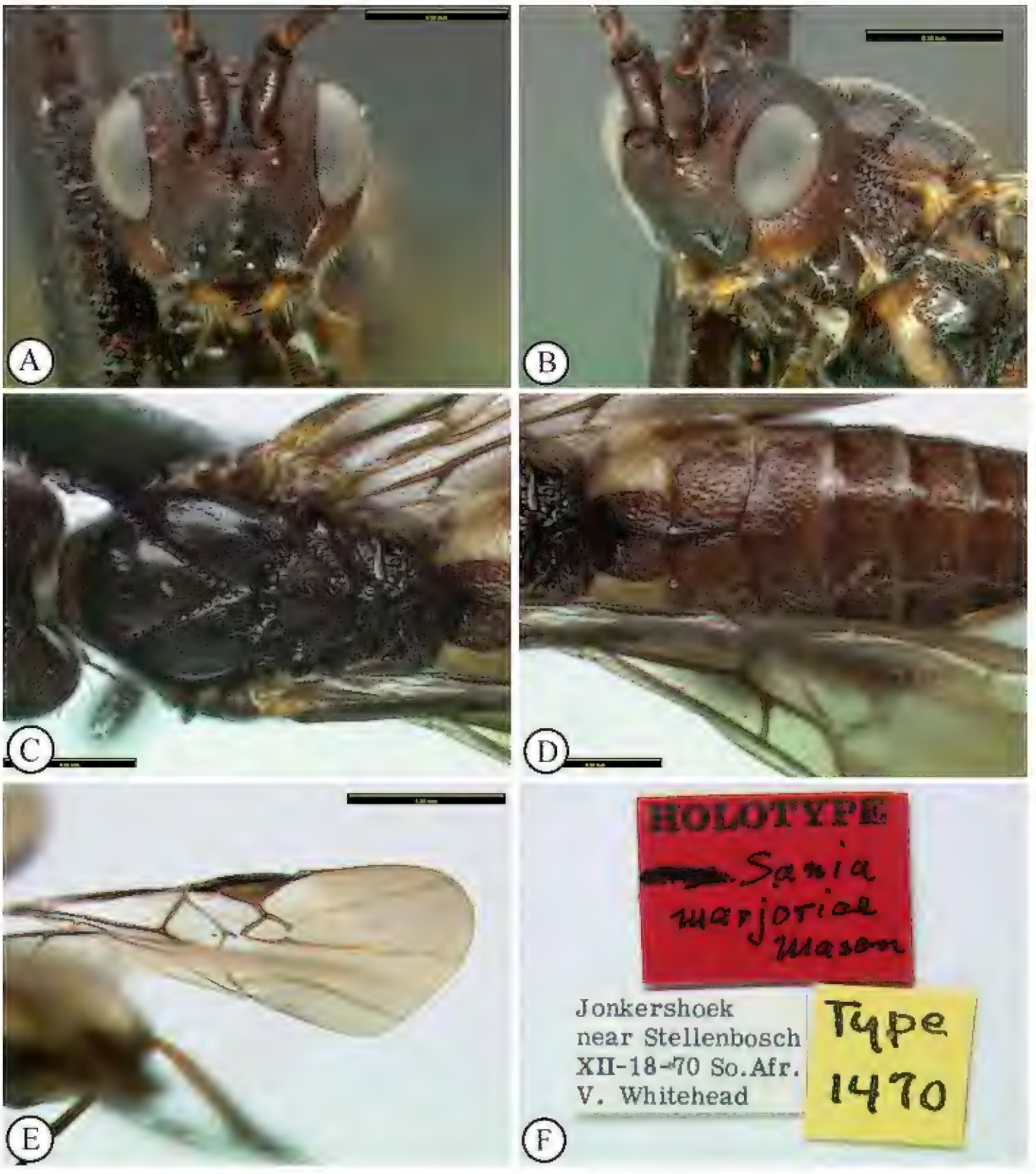


Figure 25. *Sania marjoriae* Mason, 1983, female, holotype **A** head anterior view **B** head, lateral view **C** mesosoma, dorsal view **D** propodeum, metasomal tergites, dorsal view **E** wings **F** data labels.

27A); without median tooth (Fig. 27A). Gena mostly smooth with weak punctures (Fig. 27A). Face mostly punctate with some weak rugae especially dorsally (Fig. 27A). Area between antennal scrobe and inner orbit of eye with protuberance, or without protuberance. Vertex with weak punctures (Fig. 26A). Posterior orbit of eye with distinct crenulate margin (Fig. 27B), or lacking distinct crenulate margin. Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 27C). Notauli entirely crenulate (Fig. 27C). Mesopleuron at least partly smooth with punctures (Fig. 26C). Sternaulus long occupying most of length of mesopleuron, or only present at midlength, or absent or difficult to discern due to dense sculpture of mesopleuron (Fig. 26C). Discrimen

(median longitudinal ventral sulcus between mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly punctate area (Fig. 26C). Propodeum entirely rugose without smooth area posterolaterally (Fig. 27C). Metasoma. Median tergite 1 distinctly narrowed posteriorly (Fig. 27C); partly smooth with punctures especially posteriorly, with weak rugae or microsculpture anteriorly (Fig. 27C). Hypopygium subequal to half length of metasoma (Figs. 1D, 26B); extending past apical tergum (Figs. 1D, 26B). Ovipositor more than half as long as metasoma (Figs. 1D, 26B). Setae of ovipositor sheath as much as 3 or 4× as long as width of sheath (Figs. 1D, 26B).

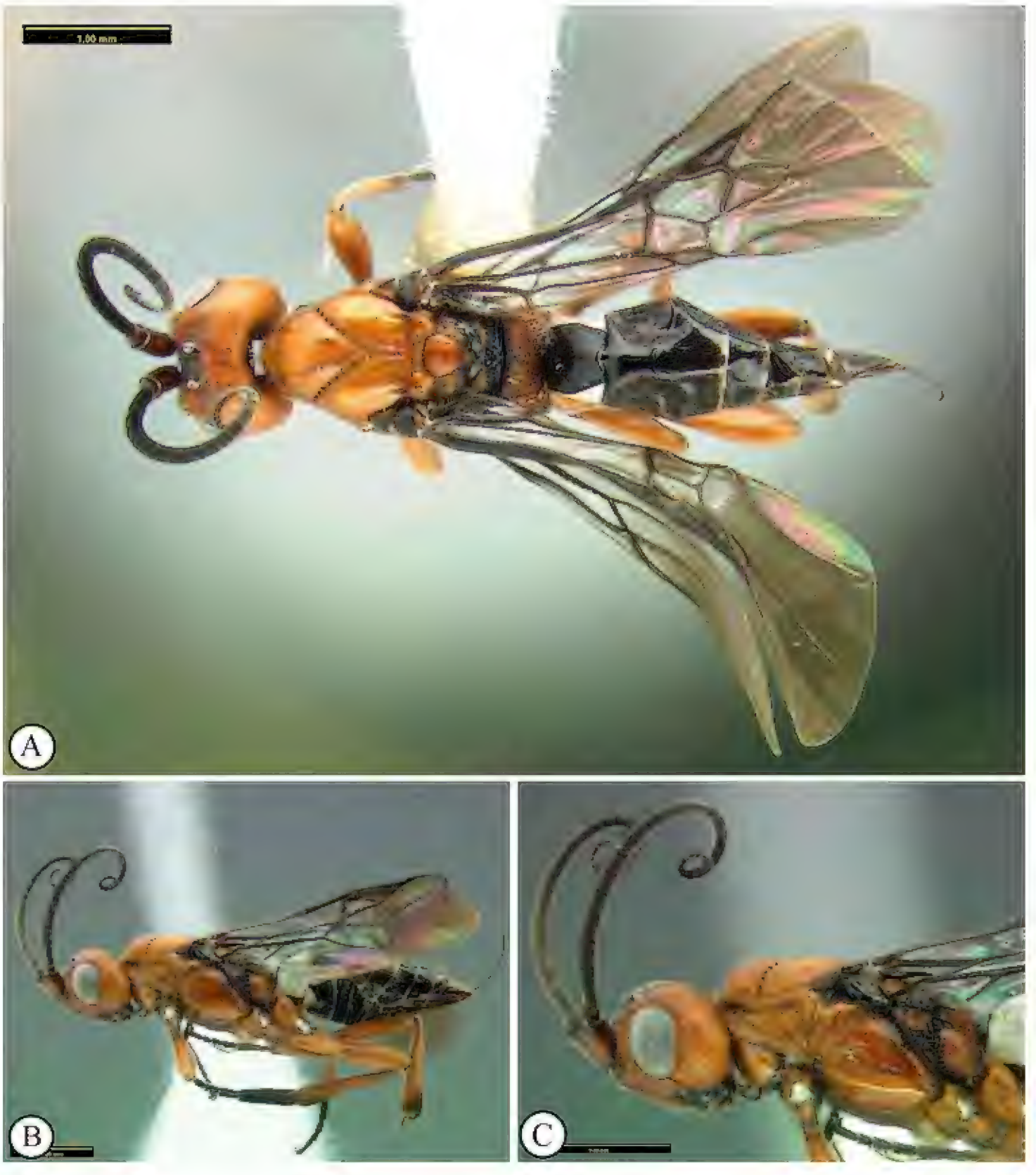


Figure 26. *Sania masneri* Sharkey, sp. n., female, holotype **A** habitus, dorsal view **B** habitus, lateral view **C** head, mesosoma, lateral view.

Male. Antenna highly sexually dimorphic with the female antennae shorter and tapering much more rapidly than those of male. Genitalia large (Fig. 2D).

Diagnosis. Scape flared apicoanteriorly with expanded apical surface (Fig. 27B); median tergite 1 distinctly narrowed posteriorly and smooth with punctures posterolaterally (Fig. 27D).

Material Examined. Holotype female: South Africa, Western Cape, 10 km S. Clanwilliam, Malaise on sandy hill, 32°13'39"S, 18°5:0'50"E, 140m, 5–25.X.2004, ME Irwin, FD Parker, M Hauser (SAMC)

Paratypes. 2 males, same data as holotype (SAMC, HIC).

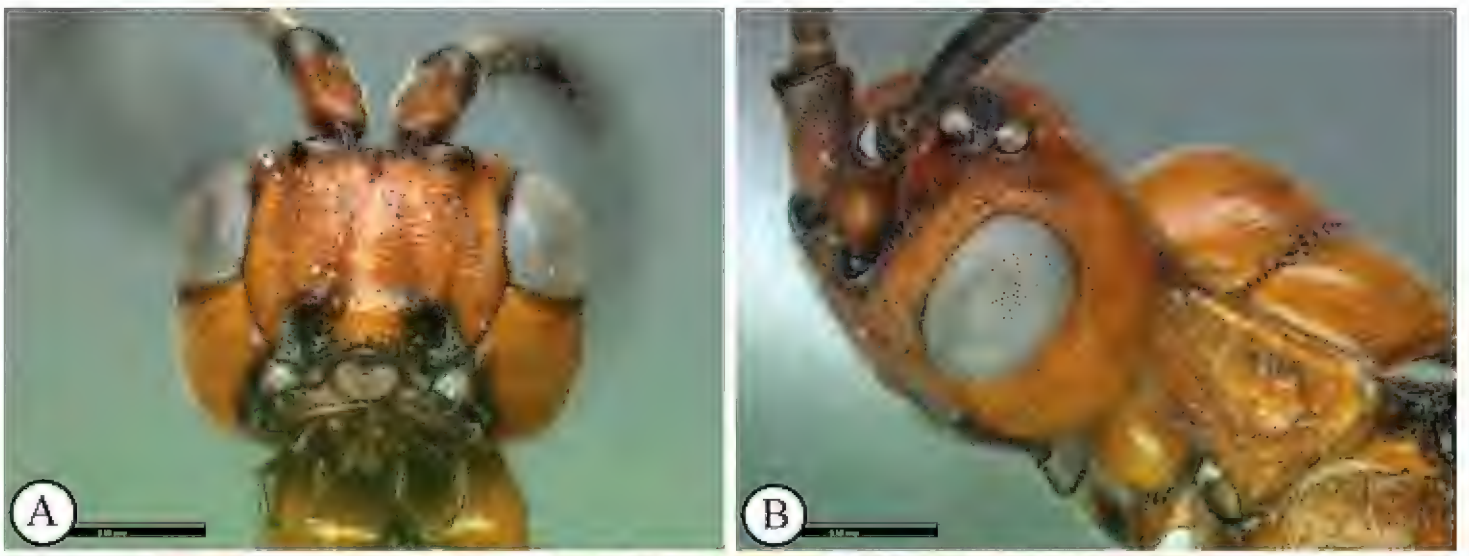


Figure 27. *Sania masneri* Sharkey, sp. n., female, holotype **A** head anterior view **B** head, lateral view **C** mesosoma, dorsal view **D** propodeum, metasomal tergites, dorsal view **E** wings **F** data labels.

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Sania&species=masneri.

Etymology. Dedicated to Lubomír Masner for his dedication to systematics and for the inspiration that he has given to so many of us.

Note. This species is referred to as *Sania* sp. n. 1 in the molecular study by Murphy et al. (2008).

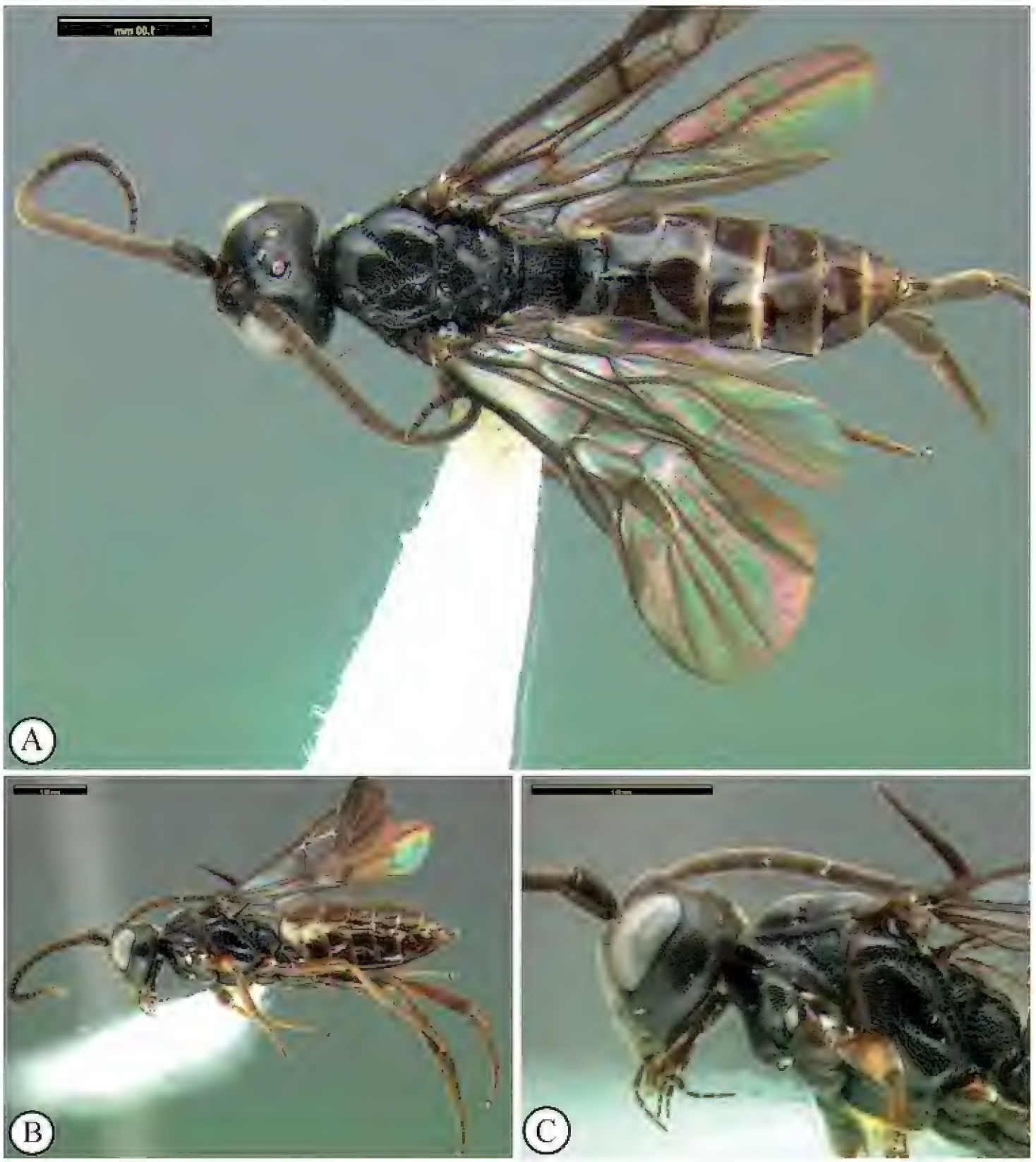


Figure 28. *Sania masoni* Sharkey, sp. n., female, holotype **A** habitus, dorsal view **B** habitus, lateral view **C** head, mesosoma, lateral view.

***Sania masoni* Sharkey, sp. n.**
urn:lsid:zoobank.org:act:DDC57A2D-20B9-4003-9B29-468B1100B7A4

Holotype female. Body Length. 4.8 mm <4.7–5.2>. Color. All black except: mandible and parts of all segments of fore- and midlegs reddish or yellowish brown, hind tibia reddish brown basally, laterotergite and sternum of metasomal tergum 1 whitish (Fig. 28) <pale color, reddish or yellowish brown, varies from as in the holotype to completely absent, although laterotergite and sternum of metasomal tergum 1 always whitish>. Forewing mostly weakly infuscate but less so anterobasally and at midlength, or clear basally,

Figure 29. *Sania masoni* Sharkey, sp. n., female, paratype **A** head anterior view **B** head, lateral view **C** mesosoma, dorsal view **D** propodeum, metasomal tergites, dorsal view **E** wings **F** data labels.

infuscate in apical half (Fig. 29E). Head. Number of flagellomeres 24 <22–24>. Scape not flared apicoanteriorly and lacking expanded apical surface (Figs. 3B, 29A, B). Antennal scrobe flat (Figs. 3B, 29B); variable, from mostly transverse-striate, to mostly smooth with punctures. Clypeus mostly smooth with weak punctures (Fig. 29A), without median tooth (Fig. 29A). Gena mostly smooth with weak punctures (Fig. 29A). Face mostly punctate with some weak rugae especially dorsally (Fig. 29A). Area between antennal scrobe and inner orbit of eye with protuberance (Fig. 29A), or without protuberance. Vertex with weak punctures (Fig. 28A). Posterior orbit of eye lacking distinct crenulate margin (Fig. 29B). Mesosoma. Middle lobe of scutum entirely smooth with punctures (Fig. 29C). Notauli entirely crenulate (Fig. 29C). Mesopleuron at least partly smooth with punctures (Figs. 3F, 28C). Sternaulus only present at midlength, or absent (Figs. 3F, 28C). Discrimen (median longitudinal ventral sulcus between mesopleura) crenulate. Metapleuron mostly rugose, lacking a large smooth lightly punctate area (Fig. 28C). Propodeum entirely rugose without smooth area posterolaterally (Fig. 29C). Metasoma. Median tergite 1 not distinctly narrowed posteriorly (Fig. 29D); partly smooth with punctures especially posteriorly, with weak rugae or microsculpture anteriorly (Fig. 29D). Hypopygium less than 1/3 length of metasoma (Figs. 1B, 28B); not extending past apical tergum (Figs. 1B, 28B). Ovipositor barely exserted, much shorter than metasoma (Figs. 1B, 28B). Setae of ovipositor sheath not longer than 2× width of ovipositor sheath (Figs. 1B, 28B).

Male. Antenna slightly sexually dimorphic with the female antennae shorter and tapering slightly more rapidly than those of male. Metasoma (Fig. 2E).

Diagnosis. Scape not flared apicoanteriorly and lacking expanded apical surface (Figs. 3B, 29A, B); discrimen crenulate; mesosoma black (Fig. 28A, C).

Material Examined. Holotype female: South Africa, Western Cape, 10 km S. Clanwilliam, Malaise on sandy hill, 32°13'39"S, 18°50'50"E, 140m, 5–25.X.2004, ME Irwin, FD Parker, M Hauser (SAMC)

Paratypes. 3 females, 18 males, South Africa, Western Cape, 15km N Citrusdal, Koedoeskop Farm, Malaise across hillside trail, 32°29'18"S, 18°57'30"E, 220m, 5–25.X.2004, ME Irwin, FD Parker, SA-34 (SAMC, AEI, HIC, CNCI, INHS).

Distribution. Distribution map is available at http://sharkeylab.org/sharkeylab/Misc/generalmapper.php?table=khoikhoiinae&genus=Sania&species=masoni.

Etymology. Dedicated to the late W.R.M. (Bill) Mason for his many contributions to Hymenopterology including the discovery of the subfamily Khoikhoiinae.

Acknowledgements

This article is dedicated to Lubomír Masner. Each of the three authors has been touched by his enthusiasm and each of us has benefited from his extensive and profound knowledge of Hymenoptera. We all wish him many more productive and happy years. We hope that including his name alongside those of his mentors and friends, Henry and Marjorie Townes, and Bill Mason in the subfamily Khoikhoiinae will please him. Support for MS was provided by NSF EF-0337220 and by a South African National Research Foundation grant GUN 61497 (SvN) and an Italian/South African Scientific

and Technological Co-operation grant GUN 2068865 awarded to SvN and Prof. M. Olmi (University of Tuscia).Thanks to David Wahl, Gavin Broad and Andy Bennett for providing specimens, to David Wagner for insights into possible lepidopteran hosts, and to Scott Robinson and Alex Wild for help and direction with the ESEM images.

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Appendix 1.

DELTA data matrix, images, and other files to the key of the Khoikhoiinae (Hymenoptera, Braconidae). doi:10.3897/zookeys.20.108.app.1.ik.

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Citation: Sharkey M, van Noort S, Whitfield J (2009) DELTA data matrix and images to the key of the of Khoikhoiinae (Hymenoptera, Braconidae). doi:10.3897/zookeys.20.108.app.1.ik. Dataset published in: Zookeys 20: 299–348. doi:10.3897/zookeys.20.108.

Appendix 2.

Interactive key, in IntKey format, to the species of Khoikhoiinae (Hymenoptera, Braconidae). doi:10.3897/zookeys.20.108.app.2.ik.

Note: To run the identification key, you will need Windows 95/NT or a later version. You also need to download Intkey software and reboot your computer, if it is not already installed. The software package, Intkey, can be downloaded from http://delta-intkey.com/www/programs.htm. Once Intkey is installed you need only click on the .ink file (below) and the key will open. Click on any character on the left to begin. More details on how to use Intkey efficiently are found at http://florabase.calm.wa.gov.au/help/keys/intkey_tutorial.pdf.

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Citation: Sharkey M, van Noort S, Whitfield J (2009) Interactive key, in IntKey format, to the species of Khoikhoiinae (Hymenoptera, Braconidae). doi:10.3897/zookeys.20.108.app.2.ik. Dataset published in: Zookeys 20: 299–348. doi:10.3897/zookeys.20.108.

Appendix 3.

Lucid Interchange Format version 3 (LIF3) file. This is an XML-based file that stores all the Lucid3 key data, allowing exchange of the key with other key developers. doi:10.3897/zookeys.20.108.app.3.ik.

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Appendix 4.

Lucid SDD file. This is a XML-based file structured using the internationally agreed SDD (Structure of Descriptive Data) Schema. This SDD file may be used to exchange the Lucid key with other SDD-compliant applications. doi:10.3897/zookeys.20.108.app.4.ik.

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